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Fluctuating Export Returns

We had occasion to express regret in these columns recently over the fact that for the first time in many months the electrical exports for November showed quite a falling off. Then came the December figures with a slight gain, resuming the onward march and noted as encouraging. Now we have the figures for January, and here we note once more with regret the sign of retrogression. Business has faltered in one way or another, but in general the signs have been those of steady, if not large, improvement. Our foreign friends may not yet be altogether out of the woods, and there have been recent periods of anxiety on European markets. Anyhow, their purchases of electrical machinery and instruments for January were only $1,947,646, as compared with $2,217,625 in January, 1913, a loss of more than 12 per cent. While last year showed up well, the returns for the seven months ended with January indicate quite clearly the dullness of the last half of 1913, for the total of the period of seven months was only about $1,000,000 better than the prior period, or, to be exact, $15,793,291, as compared with $14,638,723. The figures as now published no longer allow one to determine where the changes fall geographically, but it is probable that in our once good outlet and market, Mexico, we are electrically doing little if anything more than "watchful waiting." Trade with some other countries has also seemed to be hesitant. The facts cited above are there to prove it.

Extension of the Calgary System

A brief description of the new plant for the supply of energy to Calgary, Alberta, points a moral regarding the growth of the cities in the Canadian Northwest. About three years ago the first transmission plant was built with an equipment rating of about 9500 kva and a 55,000-volt transmission line into the city. Two years of operation showed that the growth of the demand was such as to compel immediate action and plans were made at once for utilizing an additional source of energy 2 miles above the original location. The hydroelectric installation differs from many in the far Northwest in being of a comparatively low head, only about 70 ft. The construction work represents a good example of utilizing local facilities and making the best possible provisions for economical construction. It was found that gravel available on the spot could be used for the concrete, and work proceeded rapidly, although interrupted for a time by the high water of the summer. The hydraulic arrangements are somewhat out of the usual in that the penstocks and the draft tubes are of concrete. The draft tubes themselves are 30 ft. long and gain an effective head of 25 ft., unusually high for a plant of this size. The station contains at present two 4250-kva generators carried directly by vertical-shaft turbines. The station arrangement is exceptionally convenient in that all the working apparatus is on a single floor, save the turbines below, and consequently the whole electrical equipment is immediately accessible. The switchboard, instead of being on a somewhat inaccessible gallery, is directly on the generator-room floor, the gallery being reserved for lightning arresters and the accompanying busbars. The whole arrangement of the plant is remarkably compact and convenient and the hydraulic arrangement is particularly well adapted for good regulation. In addition to the new plant, a 4500-kva generator has been installed in the original plant so that the full equipment rating now rises to 22,500 kva, a striking result of the growth of the demand over a very short period.

Maintenance of Retail Prices

Now that many opinions have been sent to Congress in regard to the involved question of maintenance of retail re-sale prices, the ideas of the lawmakers must be clearer. They have learned that the country is not of one mind on this matter. It will not do to say that because a reasonable trade practice may be an instrument of monopoly it shall hereafter be prohibited. It will not do to say that because a reasonable thing has been a practice of monopoly no man shall hereafter adopt any modification of that method. The practices of monopoly and of independent business men are sometimes strangely alike. We do not apologize for intolerable practices of business men, large or small, but want to emphasize the fact that Congress cannot legislate safely or fairly for business if it is going to bind it with red tape. The problem with manufacturers who stake their reputation and name on their goods is to reach individual consumers at a profit. If they think that the market and their fair names are best protected by requiring retail dealers to maintain a fixed price in sales to consumers, they should be allowed to adopt this method. If they sell under like conditions to all who buy, they should be secure in the methods on which they feel their prosperity rests. If other manufacturers believe in an open market and price, let them follow the policy on which they feel their success is founded. The government should allow individual manufacturers to do what their judgment and experience dictate is best for them, provided, of course, that their action is not plainly inimical to the public interest.

Shadows by Natural and Artificial Light

An article by Messrs. J. S. Dow and V. H. Mackinney in this issue deals with a topic of great practical importance. Every landscape has its variations of light and shade. Every picture which presents itself to our conscious vision possesses its particular range of variety in illumination intensity. One might, therefore, reasonably suppose that there could be no room for difference of opinion as to how artificial illumination should be applied, because each and every human being has had abundant opportunity, from his own visual experiences, to judge what conditions of light and shadow are desirable. Nevertheless, we find that there is much difference of opinion on the subject, and that, if we were to judge from the differences expressed, we might infer that the visual experiences of different individuals had been very unlike. Some express themselves in favor of deep contrasts of light and shadow, such as are formed in a room with dark walls and hangings lighted by a single open arc lamp. Others state a preference for uniform illumination in the complete absence of all shadows, such as might be produced by indirect lighting in a room with lamps concealed behind the cornice. The article here considered presents impartially the comparative advantages of these two opposing types of illumination.

The matter is really more complex than it appears at first glance because of certain associations of visual impressions and recollections which, strictly speaking, should be eliminated from the discussion. When we think of direct lighting from a single powerful lamp like an open arc lamp, we think of the violent shadows and contrasts of light and shade, which are generally considered objectionable; but we are also likely to think of the visual distress due to having to face the brilliant arc, and of the discomfort caused by the shining of the bright light in the eyes. In the case of the indirect illumination, with the light scattered in all directions from the extensive white ceiling, we remember that in whichever direction we cast our eyes no brilliant or powerfully luminous areas met the gaze. But if, in the case of the direct illumination, the arc itself be concealed from view by a suitable screen, the contrast between the two types of illumination is greatly reduced. The difference then narrows to mere questions of uniformity of illumination and intensity of shadows.

It will generally be admitted that either extreme of chiaro-oscuro presentation is ordinarily undesirable. On the one hand, dense shadows so sharp that they seem to cut into the visual field like a knife are not esthetic, although in particular cases they may be useful. On the other hand, perfect shadowlessness is also unesthetic and a little bewildering. As children of the sun, we mortals are accustomed to shadows, and we are aided in forming unconscious estimates as to the relative distance of surrounding objects by the recognition of their shadows. In a room where no shadows exist above the table level the sense of contrasts and of distances is weakened. It is true that shadows are very weak in the diffused out-door daylight of a rainy day, but it is also at least open to discussion whether the sense of mental depression in such surroundings may not be partly due to this absence of shadows.

For ordinary workday purposes, then, it may be admitted that, provided no unduly bright surfaces are allowed within the field of vision, artificial lighting should neither be all high lights and shadows nor the monotony of shadowlessness. Granting this postulate, we agree with the author that more striking and beautiful visual effects may often be secured with appropriate artificial lighting than daylight may be able to produce.

Classifications of Molded Insulations

In electrical engineering all substances may be regarded as divided into two classes, namely, conductors and insulators. As the art advances it becomes more necessary to work both these classes of materials at increasing intensities; that is, to make the conductors as powerfully conducting as possible, and to make the insulators as powerfully insulating as possible. In other words, the tendency in electric machinery is to develop as many amperes per square centimeter as possible in the conductors and to operate at as high a dielectric stress in the insulators as tests and experience show to be safe and durable.

The limitations in forcing the conducting power of conductors are somewhat narrow. They depend on electric conductivity and upon the facilities for heat dissipation. No means have yet been discovered for increasing the conductivity of metals beyond the limits that are observed in the laboratory as pertaining to those metals in the chemically pure state. It is, of course, readily conceivable that discoveries made in the future might change this limitation. There is no need for believing that this limitation is eternal. As regards the cooling of electrically active copper, improvements are slowly but steadily being made in this direction.

The limitations in forcing the insulating power of insulations are of a different nature. Here mechanical difficulties enter. It seems to be almost an inherent necessity for a good solid insulator to be brittle. Perhaps if it were both ductile and tensile at ordinary temperatures, it might have to set aside its insulating properties. At least there is much greater difficulty in obtaining mechanical strength from insulators than from metallic conductors. Moreover, poor conductors of electricity are almost essentially poor conductors of heat, so that it is difficult to apply powerful electric stresses to insulators and yet to keep their mass cool.

Much improvement has recently been made in the electric arts by molding insulation. An early successful method was that of molding porcelain material and then subjecting it to a baking and glazing process. At the present time many insulating materials are molded in a simpler fashion than porcelain. In an article of

which the concluding part is published in this issue, Mr. Emile Hemming discusses the relative merits of a number of different molded insulations, compounded, made and finished in different ways. The classifications offered as the result of comparative manufacture and tests will be helpful to many who seek to avail themselves of a proper molded insulation in the design and construction of apparatus. It is, however, necessary to remember that the conclusions from an inquiry of this kind can never be final, and that new chemical combinations and physical modes of treatment may possibly be discovered which will revolutionize all preceding ideas and practice in artificial insulator production. An enormous field appears to be open to the chemist and the experimental physicist for producing new and improved types of insulation.

Regulation According to Size

A clause in the amended bill providing for an Interstate Trade Commission gives the commission absolute power over large corporations and discretionary power over corporations without regard to size. Its language is a little obscure, however. It says that every corporation engaged in commerce (excepting those subject to the acts to regulate commerce) which by itself or with controlled corporations has a capital of not less than $5,000,000, "or, having a less capital, belongs to a class of corporations which the commission may designate," shall furnish required information. That is to say, the commission in its discretion may rule that smaller corporations shall be subject to the same supervision as large corporations. This is a departure from an early suggestion that the law explicitly exempt small corporations.

The effect of the wording will be to create a recognized division between corporate units with the capital named and those with less. The companies on one side of the line will be subject to regulation immediately and automatically, the small companies only as the commission pleases. If the object of the law is to regulate big business and to exempt little business, such a classification is appropriate, although the capital limit might be fixed higher so as to strike more directly at the large properties. This, however, is not definitely stated as the object of the law nor is it generally so understood. That it may be found desirable to bring within the law corporations having less than $5,000,000 capital, belonging to a class to be designated by the commission, is plainly inferred. The question then arises, How shall such classes be determined? Will one industry be penalized and another be immune?

There is some danger that the proposed commission may fall into the ready error of many public men in holding big business defective and little business harmless. The law should not promote that feeling. The law and the commission holding office by its authority should not hit size and disregard practices. If they do, they may encourage the development of trade practices in small companies which they will not tolerate in large companies. Size alone can never be the reasonable test. We seek mentalities of large power. Growth in volume of business is the aim of most commercial organizations. Colleges develop and enlarge. There are many small business organizations that ought to be relieved from burdensome compliance with the law but there are also many large organizations whose methods are not repugnant to just ideas. Where there is no possibility of infraction burdensome compliance with regulations of the commission should not be exacted. This policy should prevail without regard to the size of corporations.

Electricity Against the Field

Some recent German data on the relations between electricity and its nearest rivals are not unworthy of mention here. The results of competition between gas and electricity in a number of German cities during recent years, as noted in the Digest, are not a little startling. The periods considered are within the last five or ten years, and in every case for which the statistics are given it is altogether evident that the same forces are at work across the water that are operative here in gradually pushing the gas industry into a secondary position as regards lighting and motor service. The German data show the growing use of electricity for lighting in a very striking manner, the increase in some instances being twofold or threefold in the last decade, based on the yearly consumption of kilowatt-hours per capita. This change is all the more striking as much of it has taken place since the introduction of the metallic-filament lamp, so that the added consumption of energy bespeaks a much greater increase of actual lighting. Meanwhile in the same group of cities the gas consumption per capita for lighting purposes has either made only a very small increase or has actually gone down.

Similar comparisons in America would show effects, striking it is true, but quite different in their detail. The use of electricity for lighting and motor service here as abroad has increased very rapidly, but energetic competition has so stimulated the demand for light that in most places the gas consumption has kept up astonishingly well. Perhaps this result is attributable in part to the fact that while gas lighting has been pretty well driven out of large work it has managed to prosper in the very field of small consumers which has been held in altogether too much contempt by electrical central-station managers. In some large centers the gas consumption for lighting purposes has, however, considerably decreased, and while the actual output may have risen materially, it is through the miscellaneous use of the product rather than through the employment of lighting. It is not our purpose here to go into any detail regarding the situation in our own country, but merely to point out that the same inevitable forces are working in the German industries that are effective here.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Damages Denied to Marconi Company

Judge Van Vechten Veeder, of the United States Circuit Court in Brooklyn, last Wednesday handed down a supplementary memorandum to his decision in the suits brought by the Marconi Wireless Telegraph Company of America against the National Electric Signaling Company. In the memorandum Judge Veeder holds that the Marconi company is not entitled to damages for the infringement of the Lodge patent by the National Electric Signaling Company, because of the long time that has elapsed since the patent was first infringed. He said the owners of the patent made no previous attempt to assert their ownership or to complain of infringement. The Lodge patent was finally purchased by the Marconi company. An appeal from Judge Veeder's decision in both suits brought by the Marconi Wireless Telegraph Company of America has been taken on behalf of the National Electric Signaling Company to the United States Circuit Court of Appeals.

Convention of National District Heating Association

The sixth annual convention of the National District Heating Association will be held at Rochester, N. Y., May 26 to 29. Among the papers and addresses to be presented are the following: "Public Policy of Utilities," Mr. R. M. Searle, Rochester, N. Y.; "Manufacture of Welded Iron and Steel Pipe," illustrated with moving pictures; "Use of Bleeder Turbines in Connection with Steam Heating," Mr. R. D. De Wolf, Rochester, N. Y.; "Underground Construction," Mr. E. Darrow, Indianapolis, Ind.; "Records," Mr. A. P. Biggs, Detroit, Mich.; "Customers' Steam-Heating Systems," Mr. H.R. Weatherell, Peoria, Ill.; "Commercial Steam Heating in New York City," Mr. G. W. Martin, New York; "Rates," Mr. E. L. Wilder, Rochester, N. Y.; "Education," Mr. D. S. Boyden, Boston, Mass., and "Station Operating Methods," Mr. B. T. Gifford, Grand Rapids, Mich. A number of entertainment features have been arranged during the convention, including a trip to Niagara Falls by special Pullman train, Friday, May 29, as the guests of the American District Steam Company. Mr. S. Morgan Bushnell, Chicago, is president of the association, and Mr. D. L. Gaskill, Greenville, Ohio, is secretary.

Convention of Iowa Section, N. E. L. A.

The fourteenth annual convention of the Iowa State Section of the National Electric Light Association will be held at Cedar Rapids, Ia., April 22, 23 and 24. Following the address of the president, Mr. A. L. Dodd, of Charles City, Ia., the following papers will be presented: "Co-operation Between Contractors and Central Stations," by Mr. J. T. Marron, Rock Island, Ill.; "The Compensation Law and Its Application," by Mr. George A. Wrightman, Des Moines; "A Few Features of the Operation of the New Development at Keokuk," by Mr. W. A. Ross, Keokuk; "The Conduct of Public Utilities Under Commission Supervision," by Mr. A. C. Huey, Chicago; "High-Tension Lightning Protection," by Prof. A. H. Ford, Iowa City; "Is There a Saturation Point in the Sale of Electricity?" by Messrs. J. S. Forbes and J. C. Young, Cedar Rapids; "Sale of Electricity to Farmers," by Mr. Rufus E. Lee, Clarinda; "The Object and Results of Affiliation," by Mr. S. A. Sewall, New York.

On Wednesday evening there will be a banquet, and on Thursday there will be a theater party followed by a Jovian rejuvenation. The meetings of the convention and headquarters of the association will be at the Montrose Hotel, Cedar Rapids.

The Iowa Street Railway Association will hold its convention at Cedar Rapids at the same time and place as the Iowa Section of the N. E. L. A., but the program has not yet been announced.

Utilities Win Fight in California

California's attempt by constitutional amendment to require all corporations using city streets for water or for artificial-lighting purposes to procure franchises from the respective cities was declared by the United States Supreme Court on April 6 to be ineffectual as to water and light companies in business when the amendment was adopted in 1911. The private water and light companies appealed to the court to stop the State by the amendment from depriving them of several hundred millions of dollars that had been invested in the service of municipalities. The corporations claimed that the amendment was designed to enable municipalities to drive private companies out of business by refusing franchises and then to establish municipal works. The decision handed down in the case of the Economic Gas Company, of Los Angeles, turned upon rights which the corporations procured under the constitution of 1879. When this constitution was adopted Justice Hughes stated, in announcing the decision, the people were convinced that the State Legislature was moved by favoritism in granting water and light monopolies to individuals and corporations in the various cities, and for this reason the constitution provided that any person or corporation could use the streets of a city for water or light purposes without condition.

Ohio Meeting on New-Business Co-operation

The committee on new-business co-operation of the Ohio Electric Light Association will hold a meeting at the Dayton Club, Dayton, Ohio, April 15, to which central-station managers and commercial employees are invited. Nearly 100 persons attended the recent Toledo sessions of the new-business committee.

The meeting of April 15 is scheduled to open at 10 a. m. with an address by Mayor G. W. Shroyer of Dayton, after which Mr. E. L. Callahan, of H. M. Byllesby & Company, Chicago, will read a paper entitled "Suggestions to Assist Central-Station Salesmen in Securing New Business." Following luncheon there will be a round-table discussion, in the course of which the fol-

lowing topics will be taken up: "Assisting the Small Companies to Obtain New Business," "Handling the Chronic Kicker," "The Wiring of Old Residences," "What Percentage of Gross Revenue Should Be Expended for New Business and How Divided Between Salaries, Advertising and Miscellaneous Expense?" "What Benefits May Be Derived from the Commercial Application of Electric Heating Devices?" "What Disposition Can Be Made of the By-product of Woodworking Factories?"

The third and last meeting of the new-business committee will be held in Cleveland, May 22, during the Cleveland Electrical Exposition.

Mr. T. F. Kelly, of the Dayton Power & Light Company, is chairman of the Ohio Electric Light Association's committee on new-business co-operation.

Mr. Tripp on the Holding Company Bill

At the request of the *Electrical World*, Mr. Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, has expressed his opinion on the holding company bill now pending in Congress, as follows:

"I have only one criticism to make of the Clayton bill, and that is the revival of the idea that 'lessening competition' constitutes a violation of the Sherman antitrust act or any other law (unless it goes so far as to create a restraint of trade or constitute a monopoly). A practice which lessens competition is not in itself contrary to the highest standard of business ethics, nor does it menace in any degree the public welfare unless it reaches a point where it restrains or monopolizes trade. This language and the still more comprehensive language in some others of the 'Five Brothers' bills sustain the theory of free and unrestricted competition, disregarding the fact that such practices are the surest foundation for monopoly.

"It is unnecessary for me to cite instances of monopolistic corporations having been built solely by the use of the weapons of free competition. Restraint of trade and monopolies should be prevented, but elimination of useless competition by co-operation is in almost numberless cases not only desirable from the standpoint of the parties themselves, but distinctly in the interest of the public in that it prevents unnecessary waste, and co-operation of this character should not be prohibited by statute.

"As I said in the beginning, I have no criticism to make of the bill except on that one point."

Missouri Association Acts on Tentative Classification of Accounts

A meeting of the Missouri Electric, Gas, Street Railway and Water Works Association was held in St. Louis on April 1 to consider the tentative classification of accounts proposed by the Missouri Public Service Commission. The system of accounts affects all utilities except electric railways. About fifty members were present.

Resolutions were adopted asking that the date of the hearing on the questions involved be changed from April 15 to a later time, in order that those principally affected might have time to study the subject. Another resolution, asking that the effective date of the new classifications be postponed until at least Jan. 1, 1915, was adopted. Three committees were appointed to report later to the association in detail, to suggest alternatives in the proposed rules, and to advance constructive criticism. It was felt that graded classifications should be adopted, based on the gross earnings of the companies. The tentative classification is regarded as too elaborate by the association.

Mr. Philip J. Kealy, Kansas City Railway & Light Company, acted as chairman of the meeting. The committees appointed were as follows:

Depreciation—Messrs. Kealy, chairman; J. M. Scott, Kansas City Gas Company; R. C. Russum, Empire District Electric Company, Joplin; C. E. Brenton, Union Electric Light & Power Company, St. Louis, and W. H. Foster.

Historical Matters—Messrs. Hugo Wurdack, Light & Development Company, St. Louis, chairman; S. E. Bronson, Water Power Light Company, Ozark; Adrian Steele, Consumers' Electric Light & Power Company, De Soto; F. B. Saunders, Missouri Gas & Electric Company, Chicago, and J. Hall, attorney for the association.

Classifications for Small Companies—Messrs. Edwin Gruhl, Union Electric Light & Power Company, St. Louis, chairman; V. L. Elbert, St. Joseph Gas Company; S. W. Henderson, Excelsior Springs Water, Gas & Electric Company; W. J. Achelpohl, Jefferson City Light, Heat & Power Company, and S. B. Irelan, Empire District Electric Company.

The three committees will hold a joint meeting at St. Louis on April 13 and will report to the association on April 14 in order that plans may be made to attend the hearing of the Missouri Public Service Commission on April 15.

Convention of the Doherty Organization

The annual convention of managers of operating companies of the Doherty organization was held at the Hotel Manhattan, New York, on April 6 to 10. The convention was the largest of the annual gatherings that have been held by the Doherty organization. About 150 representatives of 100 companies were in attendance. Those who attended the meeting were principally general managers, new-business managers, superintendents, engineers and accountants. Nearly all the companies in the Doherty organization were represented. Ten regular sessions were held during the week. Mr. F. W. Frueauff presided at the opening session. Mr. George Williams acted as chairman during the new-business session. On the evening of April 9 there was an informal dinner at Healy's Restaurant in New York.

At the opening meeting the subject of discussion was the relation of companies to the public, state and city commissions. Addresses on this subject were made by Mr. F. W. Frueauff and Mr. C. T. Brown. The next session was devoted in part to a discussion of the new financial plan of the Cities Service Company. Mr. Paul R. Jones, secretary and auditor of the Cities Service Company, discussed the relation of the auditing department to local companies.

The sessions of April 7 were devoted entirely to the natural-gas industry and industrial gas sales. Those who made addresses were Messrs. Holton H. Scott, Alfred J. Diescher, Frank Fisher, C. L. Bullock, H. R. Straight, F. M. Lowry and Ira Neely.

On April 8 Mr. Elbert Hubbard, of East Aurora, N. Y., addressed the convention on the subject of co-operation and the relation of employees of public utility companies to the public. This session was the beginning of the meetings devoted to new-business methods. Among those who spoke were Messrs. Henry Loebel, C. L. Bullock, W. H. Gardner, M. R. Bump, Holton H. Scott, F. J. Petura and R. G. Griswold.

There was a welfare and "safety first" session at which the discussion was led by Mr. G. O. Smith. One of the sessions was devoted to the topic of operating

statistics of 1913. At the following session operating estimates for 1914 were considered. Mr. Henry L. Doherty was on the program for an address on "The Public Utility Manager." Electric vehicles were discussed on the concluding day of the convention.

Magnitude of Natural-Gas Industry

The government report issued in connection with the natural-gas industry of the United States for 1912 shows that a population of more than 8,000,000 depends largely upon natural gas for heating, cooking, industrial purposes and, to a greater or less extent, for lighting, while the natural-gas companies had in that year approximately 1,700,000 consumers.

The maximum production of natural gas was reached in 1912 in New York, Ohio and West Virginia, where it has been produced for twenty-eight years, and also in California, where production has been under way for twenty-four years; in Kentucky and Tennessee, where production is twenty-four years old, and in Oklahoma, where the first gas was produced eleven years ago. The year also saw the maximum in production for the entire country, the gas produced in 1912 being valued at $84,563,957, at an average price to the consumer of 15.04 cents per 1000 cu. ft. The value of the gas produced from 1882, when the first wells were drilled, up to the end of 1912 is given as $875,630,601.

For domestic consumption in 1912 there was distributed 193,454,802,000 cu. ft., which was sold at an average price of 26.34 cents per 1000 cu. ft., while for industrial use there was produced 368,748,650,000 cu. ft., sold at an average price of 9.11 cents per 1000 cu. ft., or a total production of 562,203,452,000 cu. ft., sold at an average price of 15.04 cents per 1000 cu. ft.

On Dec. 31, 1911, there were 28,978 producing wells in the United States. In 1912 there were 5138 wells drilled, of which 3755 were producers and 1383 dry. There were 1954 wells abandoned in 1912, and on Dec. 31, 1912, there were 30,779 wells producing gas. Large areas of land are held by the natural-gas companies. At the close of 1912 the companies owned 459,089 acres, leased 8,682,855 acres and held 1,265,940 acres by reason of operation, or a grand total of lands held by the companies of 10,407,884 acres. The largest acreage is held in West Virginia, where 3,019,316 acres are controlled, while in Pennsylvania there are 2,187,388 acres, in Ohio 1,756,167 and in Oklahoma 1,161,048 acres. As to the value of the gas produced from these holdings it was $18,539,672 in 1912 in Pennsylvania, $11,891,299 in Ohio, $33,349,021 in West Virginia, $14,492,696 in Texas, Alabama and Louisiana, and $7,406,528 in Oklahoma.

Since natural gas was first discovered in Pennsylvania the value of gas produced and sold in that State has been $355,672,362, in Ohio $114,011,567, in New York $15,986,149, in West Virginia $192,062,893, in Indiana $98,167,286, in Texas, Alabama and Louisiana $9,722,970 and in Oklahoma $21,081,670. These figures are for gas actually produced and sold and of course do not include the immense amount of gas which in the thirty-one years since natural gas has been commercially used in this country has been permitted to escape from the wells and be wasted. It is said that since natural gas became a commercial possibility in this country as large an amount has been wasted as actually has been used for domestic and industrial purposes, the greatest waste having taken place in the oil fields, although even in the natural-gas fields it has not been until within the last few years that any attempts have been made to conserve the supply.

Mr. Byllesby on Public Questions

In the annual report of the Standard Gas & Electric Company for 1913 Mr. H. M. Byllesby, the president, discusses several matters of public interest. The report calls attention to the great additional expenses with which the subsidiary companies have been burdened in defending themselves before the various taxing bodies, as well as the large legal and expert expenses incurred in connection with appearances before public service commissions. Reference is made to the benefits which are beginning to be realized from the establishment of independent and capable public-service commissions. The report continues:

"In the matter of rate regulation the tendency of the commissions, as we view it, seems to be to allow to the public-service corporations a divisible return which, after deducting from net earnings or having charged into operating expenses a suitable depreciation charge, will allow to the corporation a return upon the fair value of its property which shall be equivalent to the current return upon capital invested in other enterprises in the locality where the utility operates. The adoption of this rule will be entirely satisfactory to the Standard Gas & Electric Company."

In reference to business conditions the report says: "A pronounced suspension of activity has existed largely throughout the United States during the past twelve months. The properties at Tacoma and Everett, Wash., and the properties in Idaho, Oregon, Montana, Oklahoma, Arkansas and Colorado have felt this depression earlier and more acutely than in other sections. It is believed that this depression, as reflected in gross earnings, has reached its limit and that a recovery is now in progress which will be slower in certain sections than in others." Notwithstanding the existing agitation against holding companies, it is believed that companies of the character of the Standard Gas & Electric Company have little to fear. In no instance does the company control subsidiaries which are natural competitors.

In relation to depreciation, the report says: "When the question of a proper accruing yearly depreciation to be taken out of net earnings or included in operating expenses has been more fully determined by officials in authority in the various state commissions, or, in the absence of such determination, when the consensus of opinion on the question has reached more nearly a working basis, the controlled companies of the Standard Gas & Electric Company will adopt and put into effect whatever plan has been generally approved. In the meantime, with the large sums charged directly to maintenance and the very substantial amounts already transferred to the depreciation reserve account, it is believed that, for the present at least, the properties in which the company is interested are in a satisfactory position in this regard."

Mr. Vail Reassures Western Union Stockholders

In his annual report as president of the Western Union Telegraph Company, Mr. Theodore N. Vail discusses inquiries that have been made as to the prospects of the company, either under any possible purchase by or competition of the government or as a going concern operating independently of the American Telephone & Telegraph Company. He says that the relations between the American Telephone & Telegraph Company and the Western Union Company have always remained the same as between two entirely independent companies. The organizations of the two companies were entirely distinct and independent and, with the exception

of the president and a minority of the directors, they had no officers in common. All contracts and operating arrangements were such as two independent companies could enter into under the interpretations of the existing laws, and the commercial interests of each company were carefully guarded, so that the so-called divorce of the two companies is being accomplished with very little confusion.

As to the government purchase or operation of the telegraphs, Mr. Vail says: "The property of the company cannot be taken without just compensation; that is, a full and proper equivalent for the property taken must be returned to the owners. In such a case the shareholders should receive, as a minimum, far in excess of the present market value of the shares.

"The other alternative which has been advanced, to take over the long-distance telephone lines and enter into competition with the existing telegraph lines for the purpose of destroying their business, is not only of so questionable a character as to be repudiated when its full significance is realized, but is so utterly impossible and unworkable from a practical point of view as to make it negligible. The owners of the securities of the Western Union may rest quietly and not be scared into the sacrifice of their property. Headline prophecies should be read and regarded in the light of the results which have followed the headline prophecies of the past.

"The technical department of the company has been at work in connection with that of the Bell system in the development of what might be termed mechanical transmission, and there is now in daily use rapid transmission apparatus which nearly, if not quite, quadruples the most effective yet devised and is giving great results on the trunk lines where there is a concentrated business between large places. There is nothing as yet and not likely to be anything which will supersede the old key transmission of a scattered business distributed to many points on a local line."

Annual Report of Public Service Corporation

In the fifth annual report of the Public Service Corporation of New Jersey Mr. Thomas N. McCarter, president, discusses in detail many of the affairs of the company and its subsidiaries. The operating revenue of subsidiary companies for the year ended Dec. 31, 1913, was $34,592,473, as compared with $32,654,469 in the preceding year. Operating expenses and taxes were $18,844,607 and amortization charges were $1,007,591, or a total of $19,852,198. To the net revenue of $14,740,275 there were added non-operating income of $377,972 and income of the corporation from securities pledged and from miscellaneous sources amounting to $2,308,874. This makes a total income of $17,427,121. Deductions of subsidiary companies for bond interest, rentals and miscellaneous interest were $11,911,316, leaving a balance of $5,515,805. Public Service Corporation income deductions aggregated $3,267,605. From the net income of $2,248,200 thus obtained there were deducted as appropriations of subsidiary companies for additional amortization of capital, amortization of new-business expenditures prior to Jan. 1, 1911, and adjustments of surplus account a total of $489,635. This left a balance of $1,758,565. There were appropriated $52,375 for sinking-fund accruals applicable to 1912 and adjustments of surplus account for the corporation amounting to $20,249, or a total of $72,624. This left a net increase in surplus of $1,685,941.

The fact that the net increase in surplus after the payment of dividends was only approximately $186,000 is due, Mr. McCarter says, to the large and unusual, as compared with former years, amount set aside for amortization charges. This total was $1,376,309 in the year, whereas the amount the corporation was obligated to set aside under agreement with the bankers who made the original purchase of general mortgage bonds was only $800,000. The sum set aside for similar purposes in 1912 was $722,077. Adding $261,875, the amount set aside for the sinking fund under the terms of the mortgage securing the general mortgage bonds, gives a total for amortization and redemption of securities of $1,638,184.

Mr. McCarter states that the properties have been maintained throughout the year at a high standard of efficiency. He refers to the new power plant at Burlington, which is illustrated in the report. The corporation has continued the policy of building permanent homes for subsidiary companies in the various centers in which it conducts business. Mention is made of the plan for the construction of a modern combination street railway terminal and office building in Newark, which it is desired to complete not later than Jan. 1, 1917.

Approximately $500,000 per year is being spent by the Public Service Electric Company on new underground work. Eighteen street miles of underground conduits were laid during the year and 101 miles of transmission lines installed. The number of appliances sold, both gas and electric, increased very largely over the number sold in the previous year and should affect favorably the sales of gas and electricity during the coming year. The revenue from electric sales increased 12.13 per cent. The average revenue was 5.86 cents per kw-hr., as compared with 6.16 cents per kw-hr. in the preceding year. The report shows a total of 141,936,243 kw-hr. sold, or an increase of 17.78 per cent over 1912. The number of street arc lamps supplied at the close of the year was 12,787. The number of street incandescent lamps supplied was 22,339. The total connected load was 209,835 kw.

Taxes paid in the year amounted to $2,062,981, an increase of $189,963. In addition the corporation paid large sums to municipalities in the form of new improvements, street paving and street-paving assessments. The premium for insurance carried was 38.3 cents per $100, as compared with 44 cents in 1912. The cost of welfare work in 1913 was $65,477, divided as follows: Insurance, $16,767; sick benefits, $24,917; pensions, $14,740; expenses, $9,053. The total cost in 1912 was $61,116. The cost of accidents under the employers' liability act was $56,420. Of this the total payments provided by the act amounted to $37,335, and $10,525 additional compensation was paid under the authority of the welfare committee. Expenses of the department amounted to $8,560.

Mr. McCarter remarks that the relations of the subsidiary companies with the Board of Public Utility Commissioners have remained cordial throughout the year. He comments on the pending court proceedings in regard to the rate for gas in the Passaic district. This case was argued at the November term of the Court of Errors and Appeals. Mr. McCarter expresses confidence that that court will recognize the principle of the value of the company's franchises for rate-making purposes and sustain the justice of the company's position.

Expenditures charged to fixed capital account by the subsidiary electric company during the year aggregated $3,892,038, less $656,275, or a net charge of $3,235,763. The electric company served a total of 178 municipalities with a population, according to the 1910 census, of 1,948,923.

During the year a census was made of all power plants used for manufacturing purposes which are not using Public Service power in the territory served by the

electric company. A classification thereof has been prepared as a basis for an energetic canvass of this class of business. The total horse-power not operated by the company is 477,561, distributed among 2178 plants. Of the total number of these plants, 88.3 per cent are belt-driven and 11.7 per cent are electric-driven. The industries represented by these plants are of the most diversified character and afford a field for development of this business by the company that has great promise for the future.

Possibilities of the Electric Vehicle in Post Office Service

Colonel LeRoy T. Steward, superintendent of delivery of the Chicago post office, gave an informal but unusually interesting address before the Chicago Section of the Electric Vehicle Association on March 31. He discussed in an offhand manner the possibilities of using electric vehicles in connection with the local mail transportation in Chicago. Since the limit of weight on parcel-post packages has been raised to 50 lb. even the small post offices are handling from 10 tons to 15 tons of mail matter a day. In a few cities electric vehicles are being used to transport the volume of mail, which has been so greatly increased by the parcel post.

In Chicago the post office employs 357 vehicles in the collection and delivery of mail. About $175,000 a year is spent for this service, some of which is under contracts running out in 1915. The time is ripe for the testing out of automobiles, and particularly electric automobiles, for post office service in American cities; but the cost of horse-drawn mail wagons has been relatively low, amounting to about $1,073 a year for the wagon and driver. The question of price has had much to do with the slow progress made by the automobile in city mail service. The automobile heretofore has been deemed too expensive. The policy of the government has not been to own wagons and to carry the mails itself in the cities, but rather to let this work out by contract. There are some indications, however, that there may possibly be a change in this policy.

Electric vehicles on city streets have a distinct advertising value, and there is no reason why the post office should not avail itself of the good will and approval induced by the appearance of the smart, up-to-date electric wagons. Personally, Colonel Steward thought that the electric vehicle is the only practicable power wagon for mail service in cities. There are two reasons for this conclusion. One is that the mechanism is much simpler compared with the gas machine and is much less liable to get out of order. The second reason has to do with the human equation. Ordinary drivers can take charge of an electric automobile, whereas a mechanician is needed for the gas machine. Therefore the operating expenses are considerably less with the electric vehicle.

Mr. E. E. Witherby, of the General Vehicle Company, Mr. R. Macrae, of the Commonwealth Edison Company, and others took part in the discussion. In answer to questions Colonel Steward said that as the result of the parcel post the service of the post office is really going through a period of reorganization. The volume of outgoing parcel-post mail from Chicago is enormous —much larger than the incoming mail of that sort. The annual expense of running the Chicago post office is about $5,500,000, and the annual profits are about $26,000,000. To take the place of the street-railway mail-car perhaps 5-ton electric trucks would be needed. The field for the electric wagon in relation to city mail transportation is just beginning to be realized. The government is apparently about ready to investigate the whole automobile system of mail collection and delivery.

Meeting of Iron and Steel Electrical Engineers

The fourth regular monthly meeting of the Pittsburgh Section of the Association of Iron and Steel Electrical Engineers was held at the Seventh Avenue Hotel, Pittsburgh, Pa., April 4. An illustrated talk was given by Mr. Francis Hodgkinson, chief engineer of the Westinghouse Machine Company, on "High, Low and Mixed-Pressure Turbines." The theoretical merit and development of the different types of turbines was gone into thoroughly, Mr. Hodgkinson using lantern slides and blackboard to make his points entirely clear. The development of the turbine was interestingly described, from the 2000-kw machines of 1900 to the 30,000-kw sizes of to-day, and the reduction of steam consumption from 18 lb. to 12 lb., and of the investment charges from $120 to $60 per kw, was dwelt upon. The early uses of the regenerator in connection with low-pressure turbines were touched upon, and it was related that when regenerators were first used the regenerative period of several minutes was striven for, and that the present-day practice is to install regenerative capacity for thirty to forty seconds regenerative periods. In places where conditions are favorable the possibility of allowing the boilers to blow off into the low-pressure system instead of through safety valves was suggested, the protective features of the safety valve being maintained in addition. Mr. Hodgkinson brought out that turbine blading troubles are not caused by collision or rubbing of the blades, but rather by vibration from the steam current, and that the more substantial the blading is made the more disastrous will be the effects from collision or rubbing. The speaker went into the details of the design of turbines very thoroughly, from the throttle valve to the condenser.

Lecture on the Telephone Industry

The public utility lecture at the West Side Branch of the Young Men's Christian Association in New York on April 6 was given by Mr. T. P. Sylvan, assistant to the vice-president of the New York Telephone Company. In a brief address introducing the speaker, Mr. A. B. Leach, of A. B. Leach & Company, New York, told how the wonders of telegraphy and telephony, which were miracles a few decades ago, are to-day so commonplace as to attract little or no attention from the blasé public.

Mr. Sylvan did not touch directly upon the question of government ownership until near the end of his talk. He first took up the history of the growth of the telephone system from its early stages through the time when it was decided to place the service on a license basis, instead of on one of outright sales. The early ground-return circuits were later replaced by metallic-return circuits to the improvement of the service, as explained by the speaker, and the early aerial circuits were eventually run in cables, underground in the more congested sections and overhead in other places. The paper went on to trace the developments from the magneto system to the central-battery system of operation and signaling and the introduction of the multiple-unit switchboard.

The change from the flat rate to the message rate in charging for telephone service marked, to Mr. Sylvan's mind, the beginning of the real growth of the present immense system. The organization of the American

Telephone & Telegraph Company was effected, according to the speaker, for the purpose of handling the toll-line business between the various groups of companies affiliated in the Bell system.

Some interesting figures were given by the speaker in connection with the Bell telephone system. It employs about 200,000 people and connects about 70,000 different places in the country (comparing with 60,000 post offices, approximately, according to his figures). Over 27,000,000 calls are handled daily over the lines embraced by this system. With less than 6 per cent of the population of the globe, the United States was shown to have over 65 per cent of the telephones in the world, and, as proof that the system is still growing, Mr. Sylvan said that about $60,000,000 is likely to be spent in extensions during the coming year. It was Mr. Sylvan's opinion that when the post office and other government departments are run on the same basis of efficiency as the Bell system government ownership of the latter may be viewed with less alarm.

Discussion of Public Utility Valuation Matters

At the annual meeting of the American Society of Civil Engineers the progress report of the special committee appointed by that society to formulate principles and methods for the valuation of railroad property and other public utilities was read. The chairman of this committee is Mr. Frederick P. Stearns, and the other members are Mr. Thomas H. Johnson, Mr. William G. Raymond, Mr. Alfred Noble, Mr. Jonathan P. Snow and Mr. Leonard Metcalf. The report is entitled "Valuation for the Purpose of Rate-Making."

Subsequently an addition to this report was issued, and on March 11 the discussion of the report was continued at the headquarters of the society in New York.

Further discussion of the report was brought out in meetings held in New York on the afternoon and evening of April 2, Mr. Gardner S. Williams presiding. The afternoon meeting was opened by Mr. Williams with a brief explanation of the large importance of the subject and the advisability of thrashing it out to a definite conclusion, to which the backing of the society could be given. The main characteristics of the discussion were that it dealt almost entirely with questions of railroad valuation, to the exclusion of other forms of public utility enterprise, and that considerable criticism was aimed at the committee for bringing in the question of rate-making as an object for valuation.

A written discussion by Mr. Charles Hansel urged that the engineering work incidental to a physical valuation should be more extensively treated in the report. He advised against the society approving the report in its present form.

Prof. George F. Swain commended the report highly as to its general conclusions and the value of the matter collected, but criticised its contents regarding the question of depreciation and the bearing of that item on the whole problem of valuation. Physical depreciation he considered to be only a phase of the matter, and this may actually be quite different from what it is theoretically, depending as it does almost entirely upon the maintenance outlay. Cost of reproducing new was thought by Professor Swain to be the value upon which rates should be based, not upon this item less depreciation. He thought that a depreciation allowance should be set aside each year for keeping the property up to date without additions to the capital, and he favored the sinking-fund method for this. Any method which includes consideration of the original cost he thought would be impracticable, because in many instances the figures on this are not now available. He did not favor repeated determinations of cost of reproducing new in valuation work, but thought that one such determination, supplemented by a requirement for correct accounting, to take care of depreciation in the future, would be the most practical method of procedure.

Mr. Samuel Whinery gave a short but interesting talk on some of the general factors involved in the report. He objected to the introduction of a lot of involved theories and diction, upon the meaning of which engineers themselves are divided and which could not fail to be outside the knowledge of men of other professions. He thought that a valuation can be made without considering depreciation and that expert appraisers would pay little attention to any formulas for determining that item.

Mr. J. M. Schreiber outlined briefly the results of a similar investigation by the American Electric Railway Engineering Association, which was completed last year after three years of work.

The afternoon session proved insufficient to accommodate all who had discussions to give on the subject, so an evening session was held. Mr. J. H. H. Muirhead was one of the speakers at this meeting, and he criticised the report in several respects. In the first place he thought that it should give decided definitions. Also he thought that a fair return is not represented by 8 per cent. In his opinion, the value of the franchise should be included in the valuation of the property of a utility. He thought further that the costs of lobbying should be included in the valuation of such properties.

Mr. Jonathan P. Snow, of the special committee, spoke briefly on some of the considerations that the committee had in mind in planning and carrying on its work on the report. He said that it was the unanimous opinion of the members of that body that in valuation of property and fixing of rates the cost of the service to the producer or utility should be used, not the value of the service to the user. He stated further that one of the main objects of the committee was the furnishing of a report that would provide for the full protection of the investment in utility properties.

Mr. Gardner S. Williams resigned the chair in order to take part in the discussion, expressing his views on the proper definition for depreciation and on some of the factors that he thought should be included in a valuation. Depreciation was defined by him as the difference between the present worth of the future service of a new article or system and the present worth of the future service of the article or system under consideration. Mr. Williams thought that brains should be included in the valuation of a utility property, and since watered stock frequentiy represents capitalized brains he thought it legitimate and desirable to include watered stock in the valuation of a property.

In closing the discussion, Mr. Frederick P. Stearns, chairman of the special committee, replied to some of the criticisms which had been aimed at the report and the committee. In the first place, he said these criticisms were applicable, if at all, only to minor portions of the report. The whole question of valuation, he thought, depends upon the theory that if the owner of a utility property is to receive the benefit of an unearned increment, with the rise in value of its own and adjacent property, it should be required to bear the burden of an unearned decrement in cases where that occurs.

No definite action was taken at this meeting on the report under discussion, as further opportunity is to be given in the near future for a more general expression of the society's opinion concerning it. The other speakers at these meetings on April 2 were Mr. D. W. Linn, Mr. J. N. Dodds, Mr. C. R. Harter, Mr. M. L. Byers, Mr. H. M. Stone and Mr. T. K. Thomson.

Underwriters' Label Service

Many consumers of electrical goods who have noticed the Underwriters' labels attached to goods passed as meeting standard requirements will be interested in learning something about the label service of the Underwriters' Laboratories of Chicago. Mr. A. R. Small, superintendent of label service of the laboratories, gave a talk on the subject at the weekly luncheon of the Chicago Jovian League on April 6. He told how the label service, which has been in existence for eight years, originated as an outgrowth of the work of the Underwriters' Laboratories, established by Mr. W. H. Merrill. The labels are furnished to manufacturers of various classes of goods, electrical and otherwise, as the result of factory inspection. The service now covers over seventy devices and materials, of which twenty-five are electrical. The label service started with rubber-covered wire, rigid conduit being the next fitting to be provided with labels. The label means the actual examination of the device at the factory of the maker, and implies from 95 to 99 per cent of compliance with standard specifications.

In the case of rigid conduit, an inspector from the Underwriters' Laboratories visits the factory four times a week in busy times. He may stay from half an hour to six hours. All inspectors are governed by very explicit instructions as to their duties. In the line of rubber-covered wire, thirty-five factories in the United States and Canada subscribe to the label service of the Underwriters' Laboratories. All of these produce New Code wire. Old Code wire is now subject to a certain suspicion that it may be, in a way, scrap from New Code wire that did not fulfil the testing requirements. The rubber-covered wire factories are inspected about five times in two weeks. Manufacturers are required to make tests themselves, and the inspector has authority to re-test any New Code wire in the factory. Many tests are made by inspectors, and in ways that the manufacturer cannot anticipate. If the manufacturer is found to be weak on any point, he is required to improve his material in that respect.

The message of the label to dealers and contractors is that competitors are complying at least with the minimum requirements. The manufacturers will note that all inspection work is done at the factory, which is desirable in a number of ways. In other respects the label conveys to the manufacturers a message of distinct business advantage.

Last year the number of Underwriters' Laboratories labels increased 33 per cent over the year before. The service has justified itself. The electrical fraternity has been more active than the other industries in supporting the work of the Underwriters' Laboratories, and in turn the laboratories seek to co-operate with the electrical industry.

In a brief discussion Mr. Small said that the expense of conducting the Underwriters' Laboratories was borne by the insurance companies, so far as the building and equipment are concerned. The pay roll is met out of the receipts from the clients of the laboratories. No charge is made to manufacturers for the overhead expense of the laboratories. Labels are furnished at a flat rate, there being no discount for quantity. Rebates are made at the end of the year if it is found that service to any particular line has been rendered at a less expense than had been anticipated. The idea is to charge for the labels what the inspection service actually costs to each line of an industry, as rubber-covered wire, conduit, snap switches, etc., the different lines being figured separately. In any event, it is not planned that the label service shall cost more than 1 per cent of the manufacturing cost.

Public Service Commission News

West Virginia Commission

Attorneys representing the Elkins Coal & Coke Company have brought suit to have declared unconstitutional the hydroelectric law passed at the 1913 session of the West Virginia Legislature. The suit is brought in the form of an action to enjoin the Public Service Commission of the State from granting to the Hydro-Electric Company of West Virginia, a subsidiary of the West Penn Traction & Water Power Company and controlled by the American Water Works & Guarantee Company, a permit to erect a dam on the Cheat River, near the Pennsylvania line. The coal company asserts that the law is unconstitutional in that it permits the taking of private property without due process of law and also that the Legislature had no authority to dispose of inherent and inalienable rights of citizens of the State in the streams, such as navigation, fishing and others. The coal and railroad companies of the State, since the passage of the law giving authority to the commission to grant water-power permits, have filed many remonstrances against the granting of permits, but this is the first attack on the law in the courts.

Kansas Commission

The first report of the Public Utilities Commission of Kansas, covering the period from May 22, 1911, to Nov. 30, 1912, contains a report of the work of the engineering department on electric service and rates by Mr. F. H. Hanson, electrical engineer. The commission made a valuation of two plants in rate cases. In addition to the items of the inventory consideration was given to engineering supervision, interest during construction, contingencies, etc., in arriving at the cost of new and present value of the tangible property. As a basis for rates in addition to the present value of the physical property an allowance of 10 to 12 per cent of the yearly gross revenues was made for working capital. This item covered stores and supplies and cash on hand. An allowance was also made for going-concern value.

Where two utilities were operated jointly a certain amount of expense was incurred for the benefit of both. This expense was apportioned to each service in the same ratio as the cost was incurred. The depreciation per year was determined by dividing the depreciable values of the property by the average life of the plant. The average life of an electric plant is about seventeen years, thus making 5.9 per cent of the rate of depreciation on the depreciable property or 5.4 per cent on the total physical property with no interest accumulations. With the fund drawing 2.5 per cent interest, 4.75 per cent of cost new of the plant would suffice.

Mr. Hanson states that profits to the company should be such as will induce investors to develop the electric utility business. Consideration must be given to the efficiency of the management, since to allow the same percentage profit to the poorly managed plant as to the efficiently managed one would be a hardship upon the consumers of the poorer plant and unjust to the owners of the efficiently operated plant. The service must also be considered as a factor in determining the percentage of profit allowable. However, to allow a less profit to the plant furnishing poor service tends to make it impossible to improve the service. The better method is to require the management of all plants to maintain the same standard service and thereby eliminate the consideration of the service as a factor of the rate of return. Another factor for consideration is the over-investment in a plant of larger capacity than is necessary to supply the demand of the consumer.

Wisconsin Commission

The Wisconsin Railroad Commission has denied the application of the Sheboygan Railway & Electric Company for an increase in street-lighting rates. The utility alleged that the previous order of the commission reducing the rates for street lighting was in error and requested a reinvestigation. A review of the testimony and facts in the case failed to substantiate the charge.

The petition of the city of Sheboygan for a certificate of convenience and necessity authorizing a municipal lighting plant, on the ground that the service rendered by the Sheboygan Railway & Electric Company was grossly inadequate, was not granted by the commission. It appears that the utility has changed hands since the petition was filed and that the present owners contemplate making extensive improvements in the street-lighting service.

The Milton Water, Light & Power Company has been authorized to put into effect a minimum monthly charge of 75 cents.

Ohio Commission

It is said that the Public Utilities Commission of Ohio is sending out, or is about to send out, an order requiring all utilities in the State to file inventories with the commission on or before Aug. 1, 1914.

New Jersey Commission

The Board of Public Utility Commissioners of New Jersey has conditionally granted the Jersey Power Company permission for the issuance of $40,000 capital stock, to be used for the construction of a new transmission line from Boonton to Dover, via Fox Hill and Millbrook, and to Wharton and Rockaway, about 15 miles. The company plans to lease the power plant of the Jersey Corporation at Boonton, discontinue the power stations now in operation by the Eastern Pennsylvania Power Company at Dover and Bernardsville, and distribute from its transmission line mainly over the system of the latter company. The board imposes the following conditions upon the stock issuance: Relieving the property of the Eastern Pennsylvania company from the mortgage now executed by a Pennsylvania corporation of the same name; not to furnish local service in either Boonton or Hanover Township except as specifically permitted later by the board, such territory now being supplied; the immediate amortization by the Eastern Pennsylvania company of the power stations to be discontinued, and the amortization of the circuit to be displaced between Millbrook and Dover. The board further states that its approval of this stock issue does not imply its approval of the contract for the sale of power which is proposed between the Jersey and Eastern Pennsylvania companies.

The board has decided that the Public Service Electric Company must comply with the terms of an ordinance of the city of Plainfield, under which it agreed to light the municipal building of such city free of cost. The company contended that such clause constituted an unjust discrimination. The board holds that when a public utility bargains with a municipality for a franchise grant it acts in a unique capacity, for it may assume obligations to make a return in money or service for the franchise privilege it seeks, or it may undertake to pay the municipality a certain portion of its receipts, or undertake to afford a stipulated amount of free service. In its conclusion the board states:

"It is one thing to promise service without charge when the utility bargains with a body politic for a franchise, and it is a radically different thing to sell service to the public generally. In the first instance particular privileges are bought; in the other case the utility sells services to consumers generally. In one case it buys a franchise; in the other it sells a service."

Current News Notes

THE GYROSCOPE.—An illustrated lecture on the application of the gyroscope to marine purposes will be delivered by Mr. E. A. Sperry in the Schermerhorn Building, Columbia University, New York, on April 18 under the auspices of the department of electrical engineering.

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STUDENT SHOW AT OHIO STATE UNIVERSITY.—The Ohio State University branch of the American Institute of Electrical Engineers at Columbus, Ohio, composed mainly of students, will give an electrical exhibition on April 16, 17 and 18. Mr. L. R. Yeager is the chairman of the branch.

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ALTERNATING-CURRENT BAKERY POWER PLANT.—The new bakery plant of the Acme Tea Company, Philadelphia, Pa., which, as described in the *Electrical World* of April 4, has a daily output of 15,000 loaves of bread and is equipped with alternating-current drive throughout, was designed by Ballinger & Perrot, Philadelphia, as architects and engineers.

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LIGHT WITHOUT HEAT.—At the convention of the American Chemical Association at the University of Cincinnati on April 7 heatless-light possibilities were discussed by Prof. W. E. Bancroft, of Cornell, who said he had achieved what he called the light known as the electric firefly. This is produced by electricity under certain conditions and is not yet commercially available. The light resembles the phosphorescent light of a firefly.

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TRAVELING EXPENSES FOR SWEDISH ENGINEERS.—The Swedish government has appropriated $13,500 for traveling expenses to be distributed among Swedish engineers who desire to visit the Panama-Pacific Exposition in San Francisco in 1915. Application should contain the reason why the applicant desires to visit the exposition, the length of time of stay in San Francisco, what industrial works in the United States it is intended to visit to complete the observations at the exposition, and the total length of time the applicant intends to stay in the United States.

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NEW YORK ELECTRIC SERVICE COMPANY ENTERTAINS YALE ENGINEERING STUDENTS.—On April 2 about 100 visiting electrical and mechanical engineering students from the senior class of Sheffield Scientific School, Yale University, were entertained in New York by the United Electric Light & Power Company when the students made an inspection trip of the latter's new 201st Street generating station. The students assembled at the Engineering Societies Building and were conducted to the plant in three motor buses decorated with Yale colors. About two hours were occupied inspecting the station, after which luncheon was served by the central-station company. The tables were set in the form of a large "Y" and the numerals "14" to indicate the graduating class. In addition to some of the faculty and students the following were present: Messrs. Thomas E. Murray, vice-president of the United company; John W. Lieb, Jr., vice-president of the New York Edison Company; Walter F. Wells, vice-president of the Edison Electric Illuminating Company of Brooklyn, and others. The guests were welcomed by Mr. Frank W. Smith, vice-president and general manager of the United company, who gave a brief history of the purchase of the property and the construction of the new station. Mr. Lieb and Professor Breckenridge also made a few remarks.

SOCIETY MEETINGS

MAY MEETING OF ELECTRICAL SUPPLY JOBBERS' ASSOCIATION.—The Electrical Supply Jobbers' Association will hold its May meeting at the Chalfonte Hotel, Atlantic City, N. J., May 12, 13 and 14.

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ENGINEERING ETHICS.—At a dinner meeting of the American Institute of Consulting Engineers, Inc., to be held at the City Club, 55 West Forty-fourth Street, New York City, April 13, there will be a general discussion on the topics "The Conduct of Engineering Competitions" and "Interference by the Contractor with the Practice of the Consulting Engineer." Mr. E. W. Stern, 101 Park Avenue, New York, is secretary of the organization.

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CHICAGO JOVIAN LEAGUE.—At the luncheon of the Chicago Jovian League on April 6 Mr. Victor H. Tousely, chief electrical inspector of the city of Chicago, presided. Mr. Frank B. Chase, president of the Chicago chapter of the National Fire Protection Association, spoke briefly, announcing that the annual convention of that association will be held in Chicago on May 5, 6 and 7. The principal speaker of the day was Mr. A. R. Small, of the Underwriters' Laboratories, whose subject was the "Underwriters' Label Service."

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YONKERS DIVISION, N. E. L. A.—At a meeting of the Yonkers (N. Y.) Division of the National Electric Light Association, April 6, three papers were presented: "Line Conductors," by Mr. Edmund J. McMahon; "The Wiring of Old Residences," by Mr. George McMichaels, and "The Use of Electrical Appliances and Their Relation to the Central Station and the Home," by Mr. Joseph V. Guilfoyle, formerly of the Yonkers Electric Light & Power Company but now manager of the appliance bureau of the United Electric Light & Power Company, New York.

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LADIES' AUXILIARY TO THE JOVIAN ORDER.—At a meeting of the Jovian Electrical League of Philadelphia, Pa., to be held on Friday, April 17, at 8 p. m., the question of forming a ladies' auxiliary to the league will be discussed. This question has already been presented by Miss Dille Hastings, president of the Men and Women's Equal Suffrage League, at a luncheon of the Jovians held April 7 at Jovian Hall, Bingham Hotel. Philadelphia Jovians are seeking to distinguish themselves as the pioneers in the movement to establish a ladies' auxiliary to the order. Mr. George L. Thompson, Witherspoon Building, is statesman of the Philadelphia Jovians.

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NATIONAL ASSOCIATION OF ELECTRIC SIGN MANUFACTURERS.—At a meeting of the representatives of electric-sign interests held at the Planters' Hotel, Chicago, March 30 and 31, the National Association of Electric Sign Manufacturers was formed. After much lively discussion, a constitution was adopted and officers were elected as follows: President, Mr. George R. Hall, National Electric Sign Company, Jersey City, N. J.; first vice-president, Mr. Frederic A. Kehl, Brilliant Sign Company, St. Louis, Mo.; second vice-president, Mr. Norman B. Hickox, Greenwood Advertising Company, Knoxville, Tenn.; third vice-president, Mr. T. C. Macey, Macey Sign Company, Toronto, Ont., and treasurer, Mr. C. M. Davis, the American Sign Company, Kalamazoo, Mich.

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GRAPHIC STATISTICS FOR THE ENGINEER AND EXECUTIVE.—At a meeting of the American Society of Mechanical Engineers to be held at the Engineering Societies Building, New York City, April 14, Mr. Willard C. Brinton will read a paper describing some of the graphic methods not generally used by engineers but which, it is believed, could be of very great assistance to men who must frequently condense and abstract information and write reports. Some methods are now in use by the biologist and the statistician that could be widely applied to the work of the engineer if more generally understood. Much of the speaker's talk will be devoted to methods for keeping corporation operating records in form for instantaneous reference.

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WATER AND LIGHT ASSOCIATION OF THE CAROLINAS AND GEORGIA.—The fourth annual convention of the Tri-State Water and Light Association of the Carolinas and Georgia will be held at the Piedmont Hotel, Atlanta, Ga., April 16 and 17. The association is composed of managers and superintendents of municipal lighting and water-works plants. Among the numbers of electrical interest on the program are papers on "Accounting Systems for Water and Lighting Departments," by Mr. Joel Hunter, Atlanta, and "Watt-Hour-Meters," by Mr. L. W. Carnagy, Atlanta. There will also be an address by Mr. W. Rawson Collier, Atlanta, Ga., the subject of which is to be announced later. Mr. A. J. Sproles is president of the association and Mr. M. A. Stubbs is secretary-treasurer.

* * *

MEETING OF THE EMPIRE STATE GAS AND ELECTRIC ASSOCIATION.—The spring meeting of the Empire State Gas and Electric Association will be held at the Alert Club, Medina, N. Y., on April 22, beginning at 10 a. m. The morning session will be devoted to the new workmen's compensation law, which goes into effect on July 1, and to the accident-prevention work of the safety committee. Mr. J. Mayhew Wainwright, member of the Compensation Commission, and Mr. Cyrus W. Phillips, member of the Assembly, will be present and will address the meeting on the compensation law and its application to the gas and electric business. There will be ample opportunity following their talks for informal discussion. The safety committee has been busy drafting rules for the prevention of accidents. These, it is expected, will be ready for discussion. The committee on arrangements is Messrs. C. M. Kaltwasser, H. K. Stein and A. L. Swett.

* * *

PHILADELPHIA SECTION, N. E. L. A.—The March meeting of the Philadelphia Electric Company Section of the National Electric Light Association marked the fifth anniversary of the section's organization. Instituted in 1907 with 151 charter members, its enrolment to-day numbers 823. Prof. William J. Humphreys, physicist of the United States Weather Bureau, addressed the March 16 session on the topic "The Thunderstorm and Its Phenomena." At the meeting of the meter department branch, March 2, Mr. Charles F. Gerhard gave an illustrated talk on "The Mexican Was as It Really Is." At the meeting of the engineering department branch, March 12, medals were presented to thirty-eight employees of the company who have been in its service more than twenty years. Speeches were made by Messrs. J. B. McCall, W. H. Johnson, W. C. L. Eglin, A. J. DeCamp, J. T. Maxwell, P. H. Bartlett, and others. Before the combined meeting of the accounting and commercial department branches on March 10 Mr. H. R. Kern, auditor of the company, discussed "Commercial Law as Applied to Contracts," and Prof. W. H. Lough of the New York University School of Accounts and Finance, spoke on the subject "Business Principles."

Hydroelectric Development at Kananaskis Falls, Alberta

Extension to the Calgary Power Company's system—
30,000 hp now available for municipal and industrial uses—
Over one-third the effective head obtained in draft tubes

IN the Dec. 23, 1911, number of the *Electrical World* was published a description of the hydroelectric development on the Bow River at Horseshoe Falls, 50 miles west of Calgary, Alberta, Canada. At that point, where the river flows through a deep, narrow gorge, a solid reinforced-concrete dam was built during the winter of 1910, providing for four stop-log sluiceways, a main spillway and four hydraulically operated lift-gates, the working head being 70 ft. About 400 ft. below the dam Power House No. 1 was erected. It was designed to accommodate four units and two turbo-exciters, of the horizontal type. At that time only three units were installed, one 6000-hp turbine directly connected to a 4500-kva, 12,000-volt generator; two turbines to drive 2500 kva, 12,000-volt generators, and two 125-kw, 120-volt exciters, water being supplied by three steel penstocks. Two 3000-kw, three-phase transformers, installed by the Canadian Westinghouse Company, stepped up the voltage from 12,000 volts to 55,000 volts, at which pressure energy is transmitted over two No. 0000 stranded aluminum lines to the city of Calgary. Electricity is also supplied over two similar lines at 12,000 volts to the Canada Cement Company at Exshaw, about 8 miles west of Horseshoe.

Extensions to System

Owing to the rapidly increasing demand for electricity, it was discovered within the first two years of operation that extensions had to be made. On account of the extreme variation in the flow of mountain streams fed for the most part from glaciers (the Bow River varying from about 15,000 cu. ft. a second in midsummer to 1000 cu. ft. a second in winter) the only practical way to operate under a high load-factor was to build a second power house and to dam the river at another point. The Calgary Power Company adopted this scheme, and preparations were at once begun to harness Kananaskis Falls, 2 miles above the Horseshoe.

Dam No. 2

The most suitable place to dam the river was above Kananaskis Falls, where the Kananaskis River joins the Bow and where there is a solid rock riverbed. About Jan. 1, 1913, work, estimated to require a period of not more than a year and to cost $750,000, began on the new development. The whole project was undertaken and carried to completion by the company's engineers, whereas Plant No. 1 had been erected by Messrs. Smith, Kerry & Chace, of Toronto.

After various tests it was discovered that gravel for concrete could be obtained on the premises, resulting in a saving to the company of thousands of dollars. A light railway and traffic bridge was built across the Kananaskis River to connect the construction camp with the main line of the Canadian Pacific Railway. Early in the year the excavation for the dam commenced, and from that time the job was rushed for-

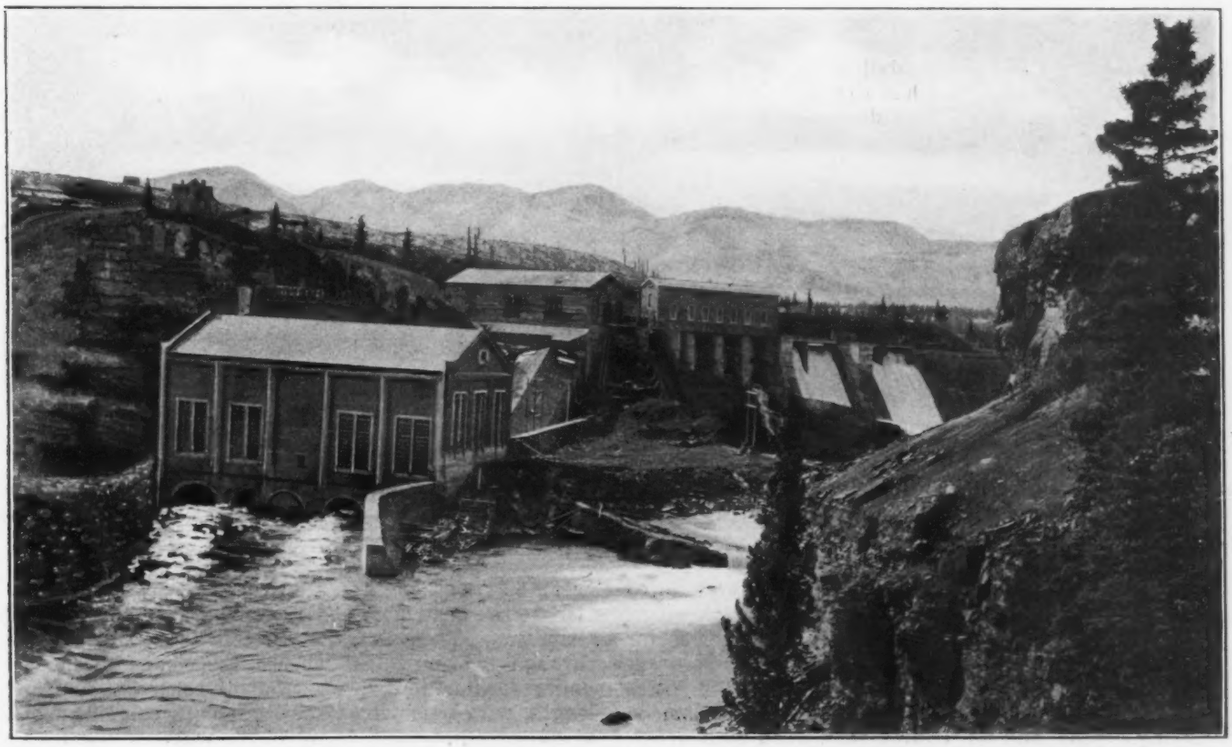


FIG. 1—PLANT NO. 1 OF THE CALGARY POWER COMPANY ON THE BOW RIVER AT HORSESHOE FALLS

ward without delay. The Bow River being a glacial stream and subject to extreme rise in flow, it was necessary that the dam structure should reach a certain height before the spring freshets interfered.

Through a solid ledge of rock extending out in the direction of the dam a temporary sluiceway was at once cut and faced with concrete, so that stop-logs could be inserted when necessary. A cofferdam was built across the stream to a point about 150 ft. from the opposite bank. When this first section of structure was completed the river had reached its summer high-water mark, and further extension of the dam in the meantime was impossible, the temporary sluiceway not being large enough to carry the flow. The completion of the north end was left till autumn, when there was less water in the river, and the temporary sluiceway was then filled in permanently with concrete.

In general the design and dimensions of the completed structure are as follows: The total length of the dam is 800 ft., which comprises eleven 24-ft. stop-log sections and seven main spillway sections also 24 ft. in length. The height of the dam to the main spillway is 57.5 ft., above which is a surface deck, acting as a traffic bridge. A traveling, electrically operated winch is placed on the top deck for handling stop-logs. Three inspection tunnels were left in the interior for draining off the seepage, and there are two main entrance drop-shafts. To minimize seepage, 2-in. holes were drilled, 2.5 ft. apart, on both sides of the dam, to varying depths, and all fissures were filled with grout.

FIG. 2—VIEW OF PLANT NO. 2 OF THE CALGARY POWER COMPANY

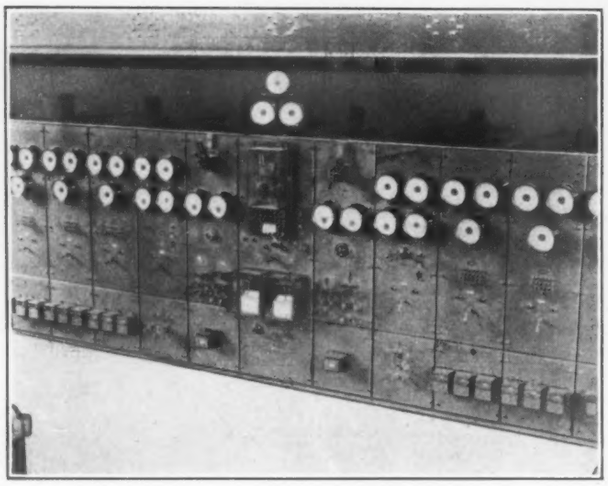


FIG. 3—SWITCHBOARD IN PLANT NO. 2, CALGARY POWER COMPANY

Canal

The power house and headworks are on the south bank of the river about 1000 ft. below the dam, and the water passes from the forebay to the headgates through a canal. From the draft tubes to the lower river the water flows through tunnels. The canal walls are lined with stone and concrete, except at its mouth, where the canal passes through solid rock. It is 700 ft. long by 80 ft. wide at the top and 50 ft. at the bottom, and permits an available water depth of 15 ft.

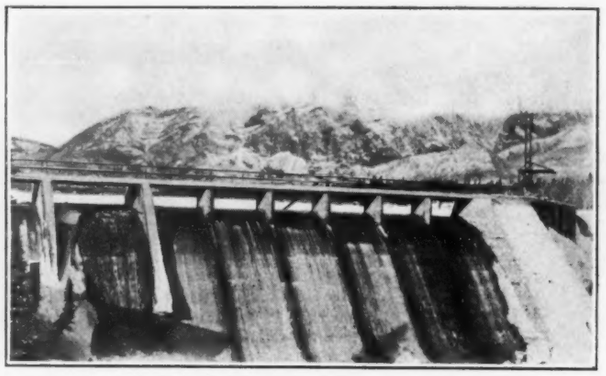


FIG. 4—DAM AT KANANASKIS FALLS, ABOVE POWER HOUSE NO. 2

Hydraulic System

Special importance is attached to the headworks, wheel chambers and tailrace systems. Water from the canal drops into two large pressure tubes built of concrete, 60 ft. in length and 35 ft. by 13 ft. in cross-section at the headgates and 12 ft. by 12 ft. at the scroll chambers. These connect directly into two turbines through wicker gates, whence the water discharges under vacuum into draft tubes of concrete, 30 ft. in length, with a varying cross-sectional area of 81 sq. ft. at the entrance to 13 ft. by 16 ft., where it discharges

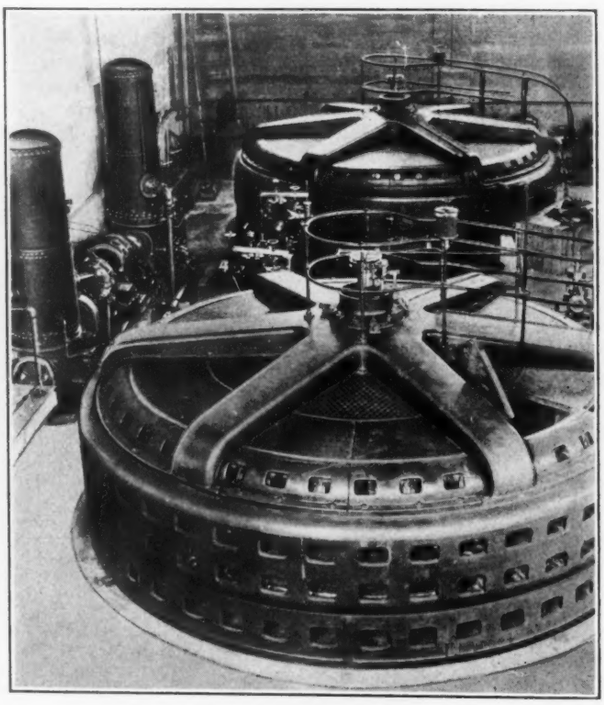


FIG. 5—MAIN UNITS IN PLANT NO 2, CALGARY POWER COMPANY

into two tunnels inlaid with concrete and is carried down to the river again below the falls. With this arrangement a total head of 70 ft. is maintained, about 25 ft. being gained through vacuum in the draft tubes. To regulate the head-water supply two stop-log openings and two Tainter gates are installed for each pressure tube. The Tainter gates were designed and built

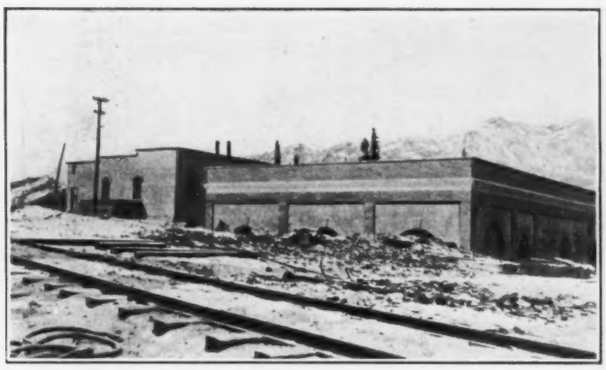


FIG. 6—TAINTER GATE HOUSE, PLANT NO. 2, CALGARY POWER COMPANY

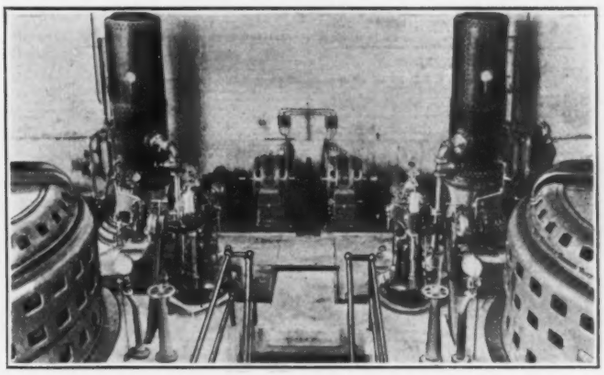


FIG. 8—WATERWHEEL GOVERNORS IN PLANT NO. 2, CALGARY POWER COMPANY

by the company's engineers and are housed by a building of hollow tile and plastered cement to harmonize in general with the architectural design of the power house.

Power House

The power house is economically arranged for its ultimate installation. It is 90 ft. long by 60 ft. wide, with foundation walls built up for 15 ft. of solid concrete, above which tile plastered internally and externally is used. On the main floor are the generators, switchboards, station-service transformers, storage battery and machine shop. From the lower floor access is had to the turbines. An upper gallery supports the lightning arresters and busbars. The hydraulic equipment comprises two 5800-hp vertical-type, single-runner, reaction turbines, built by the Canadian Allis-Chalmers Company, of Montreal, supported on Kingsbury bearings and controlled by oil governors manufactured by the same company. These turbines are directly connected to two vertical-type generators, rated at 4250 kva, 12,000 volts, three-phase, 164 r.p.m., sixty cycles, manufactured by the Swedish General Electric Company. Excitation energy is obtained from one vertical turbo-exciter, rated at 75 kw, 220 volts, 600 r.p.m., and one motor-generator exciter of the same rating. Three 75-kw single-phase transformers step down the voltage from 12,000 volts to 2200 volts for local distribution and power-house service. A 50-ton electric crane is installed for handling all machinery. The switching apparatus and electrolytic lightning arresters were supplied by the Canadian Westinghouse Company. Direct current for remote control is delivered by an 80-amp-hr. storage battery, discharging at about 120 volts.

Exceptional progress was made in carrying out the development under the direction of Mr. C. W. Allen, construction superintendent, and Mr. H. S. Johnson, who had direct supervision of all details of design. About the middle of December the first wheel was started, and up to the present it has been carrying its share of the load. The second unit has since been tied in. The successful accomplishment of this hydroelectric scheme was not without certain difficulties, but under the skilful organization of Mr. H. A. Moore, general manager and chief engineer, these were overcome satisfactorily. The Canadian Pacific Railway Company's steel bridge across the Kananaskis River had to be raised 4 ft., and a retaining earth wall had to be built half a mile above the dam on the Bow River to protect the Canada Cement Company's shale pit, situated on the south bank.

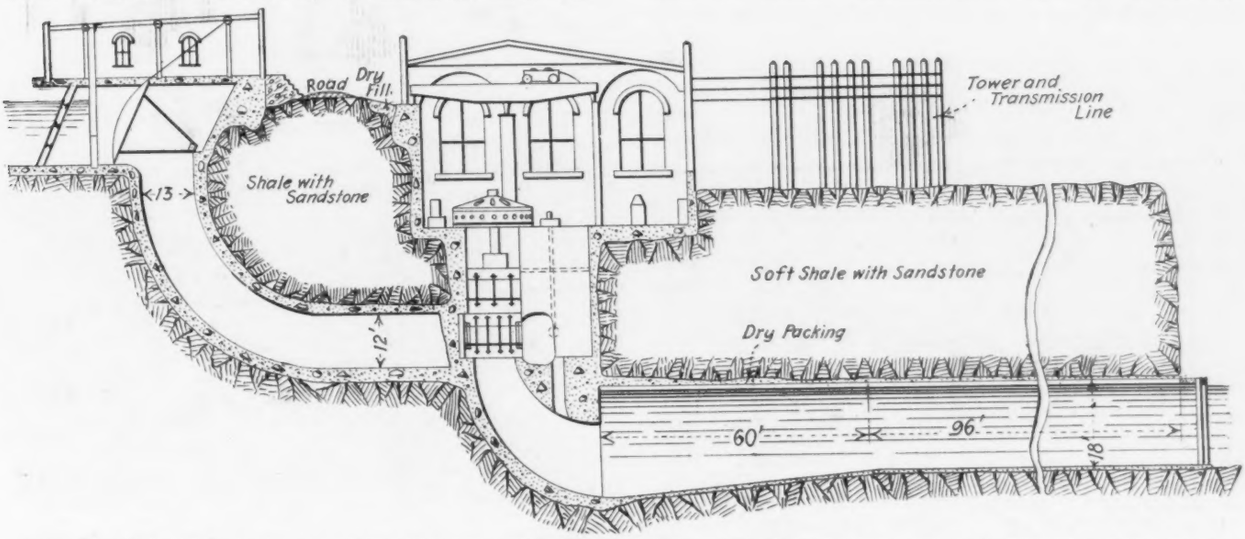


FIG. 7—CROSS-SECTION OF POWER HOUSE, HEADWORKS AND TAILRACE TUNNEL, NO. 2 PLANT OF CALGARY POWER COMPANY

Combined Rating of Plants

During the summer of 1913 a fourth unit, comprising a 6000-hp, 225-r.p.m. Wellman-Seaver-Morgan Company horizontal turbine directly connected to a 4500-kva, 12,000-volt, three-phase generator erected by the Canadian General Electric Company, was installed in Plant No. 1 with a steel-riveted penstock 12 ft. in diameter. Two additional 3000-kw, 12,000-55,000-volt,

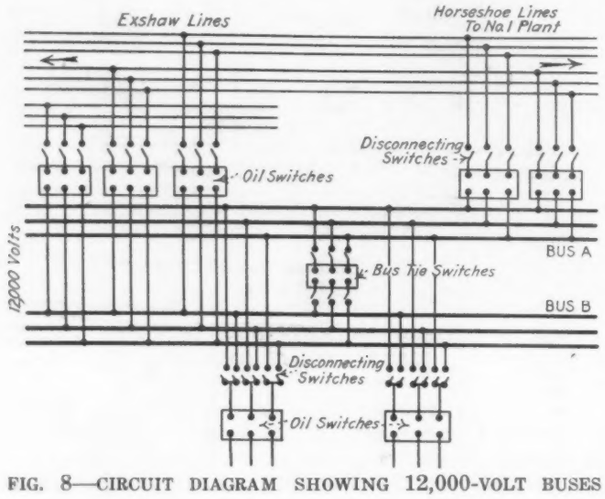


FIG. 8—CIRCUIT DIAGRAM SHOWING 12,000-VOLT BUSES

three-phase transformers were installed by the Canadian Westinghouse Company.

The company has now available approximately 30,000 hp. The two stations are tied by a double-circuit aluminum line, so that either station can supply electrical energy to the city of Calgary or the Canada Cement Company at Exshaw, or to both. The transformers in Plant No. 1 step up the voltage for both stations. The section of 12,000-volt lines from Plant No. 2 to its junction with the former Exshaw lines is made up of five-circuit No. 1 solid copper wire. A third aluminum circuit has been added from this point to Exshaw on double-pole structures, and the terminal station there has been enlarged to meet the increased demand for energy.

The problem of storing water for the winter season was partly solved two years ago by building a dam across the Cascade River at the outlet of Lake Minnewanka, about 40 miles west of the hydro stations. The lake, 3 miles long by 1 mile broad, is fed from glaciers and empties into the Bow River. By means of the 70-ft. high concrete dam the water was elevated about 13 ft. This additional storage supply is regulated by three stop-log openings, each 10 ft. wide.

Hydroelectric Plant with Induction Generator Operated Without an Attendant

A very interesting example of a non-attendant power plant is afforded by the recent installation of what is known as the Green River plant of the Greenfield (Mass.) Electric Light & Power Company. The company has a 3000-kw steam plant situated on the bank of a small stream known locally as the Green River. Water from this stream is used at the steam plant for boiler-feed and condensing purposes, a pond being formed by a dam across the stream below the plant, this pond having an area of approximately 10 acres.

During the year 1913 it became apparent that the dam (an ancient log structure) would have to be renewed. It was therefore decided to build a concrete gravity type of dam primarily for securing the water supply of the steam plant.

Investigation seemed to show that a small amount of power could be generated in connection with the dam, provided the operating expense could be kept at a low value. After due deliberation a 24-in. double-runner horizontal waterwheel was installed and belted to a 100-hp, three-phase, 2300-volt squirrel-cage induction motor, the motor being driven above synchronous speed so as to operate as an induction generator.

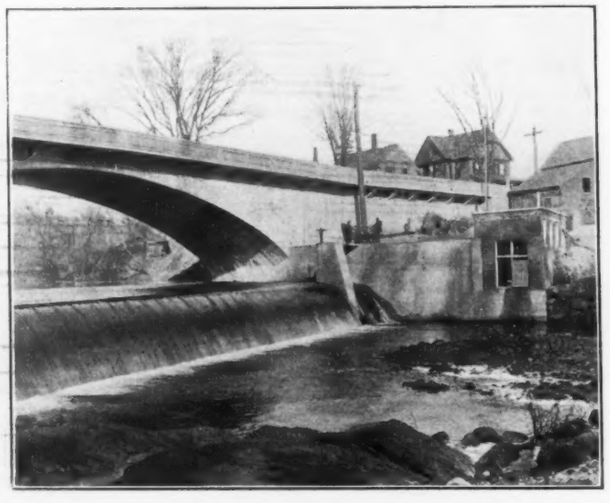
The waterwheel is controlled by a governor which holds the no-load speed about 15 per cent above normal, so that while normally the wheel runs at full gate opening, if the load drops off for any reason, the set will not run away.

The motor is connected through an automatic switch and meter to the 2300-volt distribution line of the company right at the plant. Ordinarily there is sufficient load on this line to absorb the output of the induction generator. At times of light load the output of the generator is fed back into the main station bus.

If the switch on this feeder at the main station should open for any reason, the induction generator loses its excitation but keeps right on running. When the switch is closed the generator becomes energized and immediately picks up its portion of the load. The process of starting up is simplicity itself; the wheel being started and the machine brought up to approximately synchronous speed, the switch is closed and the operation is complete. Provisions are made for operating one runner of the wheel separately in times of low water.

The normal attendance of this plant is limited to a visit three times a day, at shift changes in the main plant. The operator stops at the plant on his way to work, reads the meters, feels the bearings and observes the general condition of the machinery, racks, etc. The plant was placed in operation Jan. 1 and is fulfilling all expectations as to reliability and low operating costs.

The dam has a height of 11½ ft., including flashboards, and a spillway of 160 ft. The wheel chamber is



GREEN RIVER PLANT OF GREENFIELD ELECTRIC LIGHT & POWER COMPANY

built integral with it at one end and the generator is housed in a brick building adjacent to the wheel chamber, the wheel shaft running through a stuffing box into the generator room.

The dam and building were built by Messrs. F. T. Ley & Company, contractors, under the direction of Mr. H. A. Moody, hydraulic engineer on the staff of the Greenfield Electric Light & Power Company.

Classification and Characterization of Molded Insulations—II

Additional data on the mechanical and electrical properties of molded insulations and on the types which are best adapted for particular uses in the arts. By Emile Hemming

LAST week's issue of the *Electrical World* contained the first part of this article, dealing with the division of molded insulations into nine general classes and the characteristics of some of these. The instalment which follows concludes the discussion, with illustrations and tabular data.

Rubber is the only moldable insulation which in itself, without the admixture of a filling or strengthening medium, presents all the desirable qualities of an insulator. Its toughness, elasticity and flexibility are not even approached by other insulations. It is therefore unsurpassed as a binder for organic and inorganic fillers when not subjected to a continuous temperature of 100 deg. C. or over.

Experiments are being conducted to render celluloid less inflammable and hence more suitable for electrical insulation. This material is especially adapted to use

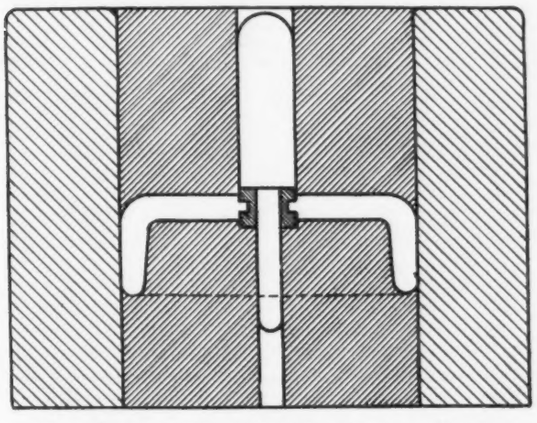


FIG. 4—DIE FOR HOLDING METAL INSERTS

where ornamental appearance is paramount. Celluloid is a good insulator and can be molded with more ease than perhaps any other material. The substance loses its color and transparency at 140 deg. C. and decomposes at about 190 deg. C., giving off inflammable vapors. Celluloid is not soluble in water, but gradually dissolves in concentrated sulphuric acid.

Albuminoids, or casein, were produced to obtain a substitute for celluloid which would have greater heat resistivity. These products are not stable under the action of moisture, however, unless treated with formaldehyde. Casein is easily worked with tools and withstands 20 deg. to 30 deg. C. higher temperature than celluloid. It chars upon the application of heat without burning.

Synthetic resinous materials have all of the advantages of hot-molded insulations and possess higher heat resistivity. These phenol-formaldehyde products are ordinarily brittle, but when organic or inorganic fibrous materials are incorporated in them they equal or surpass all known insulations except rubber products in strength.

To produce the reinforced material, the phenol-formaldehyde condensation product is heated until plastic when hot and hard when cold, pulverized, and mixed with the fibrous filler. The mixture is heated in dies under pressure until plastic and then transformed into the hard, infusible state, or the plastic hot mixture is molded in sheet or cake form directly in dies without first pulverizing. The filler (usually wood pulp or asbestos) must be added before the binder reaches the infusible state.

The heat resistivity of these reinforced synthetic resinous insulations depends on the material used as a filler. A compound containing wood pulp can withstand 175 deg. C., while one containing asbestos may be subjected to temperatures up to 250 deg. C.

Exposure to moisture and water for several years would indicate that this class of insulation is unaffected thereby, but its relative moisture-resistivity compared with rubber is not definitely decided at the present time. The compounds containing a wood-pulp filler after immersion in water for several months appear to be affected more than those containing inorganic fillers. The more of the latter filler used the better can the resulting insulation withstand electric arcs, while the more binder employed, the easier it is to mold the articles and protect them against moisture. Absolute accuracy in dimensions can be obtained by molding this insulation.

TABLE I—MOLDED INSULATIONS ADAPTED TO THE MANUFACTURE OF DIFFERENT ARTICLES

Articles Preferably Made from Molded Insulation	Class of Materials to Use
Receptacles, sockets, rosettes, fuse blocks, wire cleats, etc.	D and B best suited, D especially, because of low cost.
Various types of switch handles	Practically limited to A and B; C, E and G not so suitable on account of finish or cost.
Small handles and knobs	A best where no heat resistance required; B good.
Receiver cases, telephone mouthpieces, terminal boards, etc	A and E best.
Overhead-line and strain insulators	A used almost exclusively; E very good; G would be ideal except for a high cost.
Magneto distributors, collectors and similar parts	G used almost exclusively.
Bushings	G and E best where great strength required; B and C suitable, and A where no high heat resistance required.
Synchronizing plug handles, etc	A best, followed by G and B.
Charging and contact plugs, etc	B, C and G best; D brittle.
Connector and plug parts for electric flatirons and electrical heating appliances	B used almost exclusively; C next best because of high heat resistance.
Terminal bushings and contact parts subjected to intense heat	C used almost exclusively.

NOTE—G could be used in most of the above cases except for high cost.

Vulcanized fiber is prepared by treating vegetable fibers with zinc chloride or other metallic chlorides, alkaline compounds and sulphuric acid, to produce a glutinous mass which is pressed into sheets, tubes, etc. The chemicals used in the manufacturing process unless removed will impair the insulating qualities of the fiber. Vulcanized fiber is unaffected by organic solvents and

is tough and easily worked with tools, but will char and hold a flame after exposure to 175 deg. C.

Fiber treated with a resinous binder is very stable and has good mechanical properties. Its heat resistivity depends on the softening temperature of the binder.

Molded mica is made by cementing together with resinous binder thin laminas or flakes of mica, which are afterward subjected to pressure and heat to form a compact product. If mica in a powdered form could be successfully cemented together with an inorganic binder, its use would be extensive.

Either the open or closed die can be used in hot-molding insulations, but cold-molded products should be formed in closed dies only. It is customary to weigh the material when plunger-type dies are used, with the exception of porcelain, which is measured by volume. Metal parts should be knurled or roughened, to prevent loosening, if they are to be molded in an article.

When letters have to be molded on an article which cannot be removed from the die in an entirely finished condition, and subsequent hardening, grinding and polishing is necessary, the following procedure is considered good practice: Recess a portion of the surface, leaving the embossed letters flush with the surface so that when the final finishing and polishing is done the letters will receive the same finish as the rest of the surface.

Articles made of Class B, C or D materials should not have thin parallel walls, as it is difficult to mold them with sufficient mechanical strength. By designing the walls with a taper, molding is facilitated and mechanical strength increased.

By designing pieces which are ordinarily molded in hot dies with fillets and tapers instead of square cor-

TABLE II—CHARACTERISTICS OF MOLDED INSULATIONS

Class of Insulation		A	B	C	D	E	F	G	H	I
Mechanical strength		Less brittle than D.	Less brittle than D.	Less brittle than D, better than A or B, and poorer than E, G or H.	Brittle, good tensile strength, low elasticity, cannot withstand shock or vibration.	Strong.	Fairly strong.	Strong.	Very strong.	.....
Effect of moisture		None when high-class gum is used and when there is no excess of filler.	Negligible; used outdoors successfully ten years.	None if treated; successfully used outdoors ten years.	No effect if glazed.	None unless containing asbestos fiber, when dielectric strength is affected slightly.	None on celluloid; bad on casein because hygroscopic.	Same as A during time it has been on market.	Ordinary form hygroscopic, new type not so.	.....
Heatproof qualities — Allowable temperature	Momentary	.....	500 deg. C.	1500 deg. C.	Lavite is preferable for heat-resisting	100 deg. C.	.....	300 deg. C.	200 deg. C.	175 deg. C.
	Continuous	80 deg. C.	300 deg. C.	900 deg. C.		80 deg. C.	80 deg. C.	150-250 deg. C.	80-100 deg. C.	80 deg. C.
	Effect of heat	Binder melts.	At higher heat material deteriorates.	At higher heat material deteriorates.	Porcelain liable to crack with sudden temperature change.	Seriously affected by continued heat.	Affected by continued heat; decomposes giving off vapor.	At higher heat material deteriorates.	Vulcanized product liable to warp at 100 deg. C.	Shellac melts.
Stability		Excellent if high-grade material is used, but reduced by adulteration.	Good.	Good; improves with age.	Excellent.	Excellent when properly compounded.	Good at low temperatures.	Good.	Affected under atmospheric conditions with ordinary grades, but new type containing hardened vegetable fiber is stable.	.....
Adaptability to molding	Type of work	Excellent for accurate work; metal parts can be embedded.	Good for all work where variation in accuracy up to 0.01 in. can be allowed.	Especially good for flat plates and large pieces; metal parts can be embedded.	Metal parts cannot be embedded.	Excellent for accurate work; metal parts can be embedded.	Metal parts can be embedded.	Excellent for accurate work; metal parts can be embedded.	.....	.....
	Method of molding	Hot.	Cold.	Cold.	Cold.	Hot.	Hot.	Hot.	Pressed in sheets.	Built up of flakes or sheets.
	Shrinkage	None.	Some manufacturers claim they can mold to size, others guarantee variation within 0.010 in.		As high as 15 per cent in firing; allow 0.015 variation per inch.	None.	Moderate.	None.	.....	.....
Insulation dependent on		Compounding of products.	Mixture and pressure.	Compounding and treatment.	Chemical components.	Compounding of products.	.....	Nature of synthetic binder and filler.	Physical treatment and seasoning with ordinary fiber, and on temperature pressure and synthetic cement in new types	Mica.
Resistance to chemical action of acid or alkali		Doubtful.	Doubtful.	Doubtful.	Excellent.	Good to a certain extent if specially compounded hard rubber.	Doubtful.	Doubtful.	Doubtful.	.....
Adaptability to machining		Can be machined, but better to finish in mold.	See A.	See A.	Cannot be machined.	See A.	See A.	See A.	Especially adapted to machining.	.....
Natural color		Black or brown.	Black; depends on ingredients.	White or black.	White.	Gray-brown when containing asbestos; black if ordinary hard rubber.	.....	Reddish-brown or black.	.....	.....
Other colors obtainable		Various colors.	.....	Various colors.	Various colors by glazing.	Various colors.	Particularly adapted to coloring.	Black and other colors.	Various colors, but usually gray, black or red.	.....
Finish obtainable		Leave die with high polish, but can be buffed.	Flat and lusterless.	Smooth, close-grained.	High finish with glaze.	See A.	See A.	See A.	.....	.....
			Must use abrasive and buffer to obtain high polish.							

(From "Molded Electrical Insulation and Plastics," by Emile Hemming.)

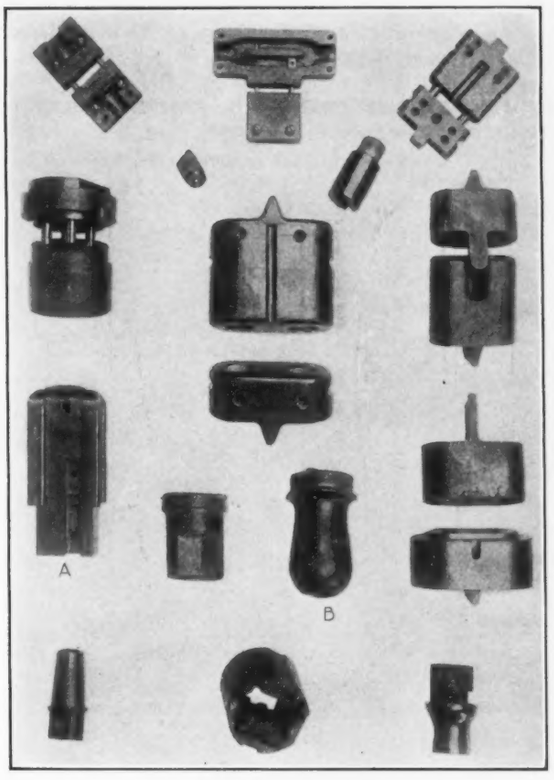


FIG. 5—PLUG PARTS MADE OF MOLDED INSULATION

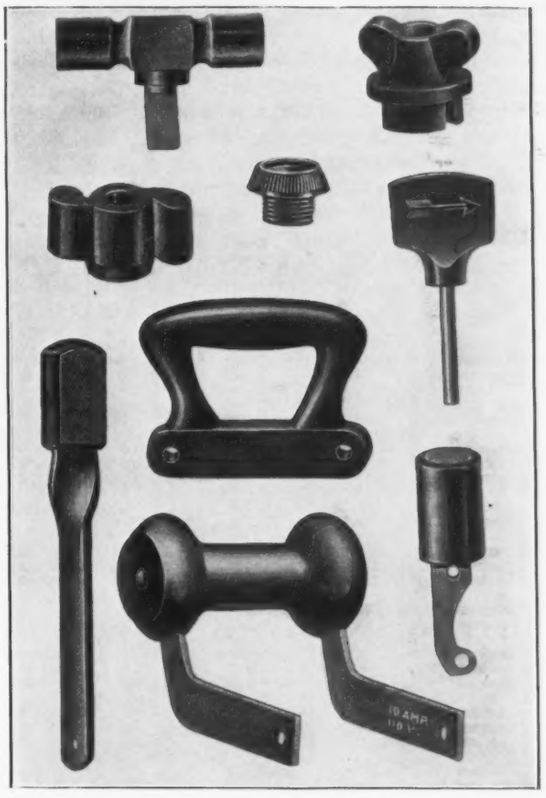


FIG. 7—SWITCH HANDLES OF MOLDED INSULATION

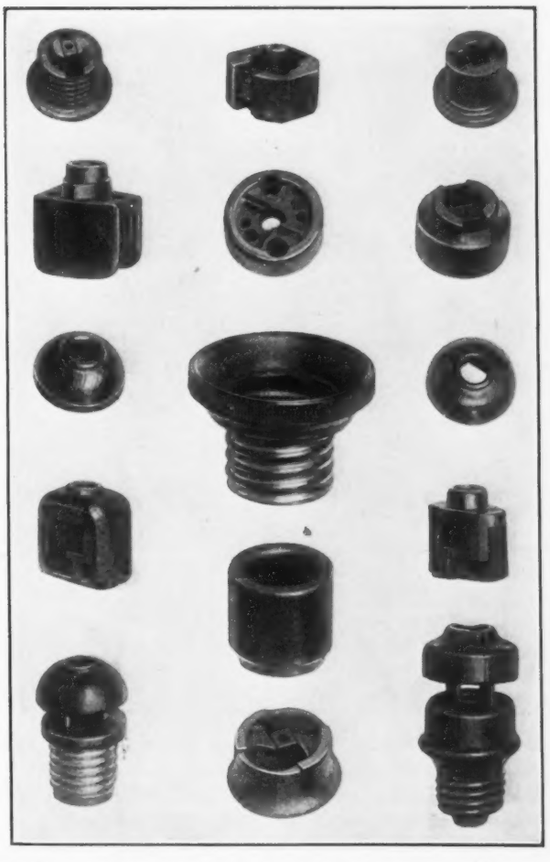


FIG. 6—INCANDESCENT LAMP PARTS MADE OF MOLDED INSULATION

FIG. 8—ROSETTES, FUSE BLOCKS AND SOCKETS OF MOLDED INSULATION

ners, it will be possible to produce many of them by the cold-molding method, which is cheaper and also much faster.

The data tabulated herewith on the dielectric strength, ohmic resistance and tensile strength of molded insulations subjected to various conditions are the results of tests made in the Electrical Testing Laboratories, New York, under the supervision of Mr. F. M. Farmer. The samples used had the following dimensions:

Class A—Plates, 2½ in. by 1⅞ in. by ½ in., cut from molded plates, 6 in. by 4 in. by ½ in.

TABLE III—OHMIC RESISTANCE OF MOLDED INSULATIONS

Class of Molded Insulation Tested		Megohms per Inch Cube with Samples Tested Under Conditions Below			
		As Received	After Immersing in Water 72 Hours	After Subjecting to 100 Deg. C. for 12 Hours	After Subjecting to 200 Deg. C. for 12 Hours
"A"	Specimen No. 1	235,710	513	1,000,000+*	1,000,000+‡
	Specimen No. 2	60,700	890	1,000,000+*	1,000,000+‡
	Specimen No. 3	174,200	1070	1,000,000+*	1,000,000+‡
"A" (a)	Specimen No. 1	1,000,000+	800,000	.....	.....
	Specimen No. 2	1,000,000+	600,000	.....	.....
"B"	Specimen No. 1	21,300	470	25,800	350,000
	Specimen No. 2	18,070	380	36,100	405,000
	Specimen No. 3	12,300	710	30,400	341,000
"B" (a)	Specimen No. 1	51,200	14,300	.....	.....
	Specimen No. 2	40,700	17,210	.....	.....
"C"	Specimen No. 1	290,000	900	1,000,000+	1,000,000+
	Specimen No. 2	115,000	1,320	1,000,000+	1,000,000+
	Specimen No. 3	240,000	1,150	1,000,000+	1,000,000+
"C" (a)	Specimen No. 1	24,900	21,110	.....	.....
	Specimen No. 2	28,100	19,000	.....	.....
"G"	Specimen No. 1	65	51.0	1,790	850,000†
	Specimen No. 2	93	40.0	2,310	970,000†
	Specimen No. 3	76	42.0	3,840	680,000†
"G" (a)	Specimen No. 1	.....	7,590	250,000	1,000,000+*
	Specimen No. 2	.....	11,400	340,000	1,000,000+*
	Specimen No. 3	.....	8,100	276,000	1,000,000+*
"G" (b)	Specimen No. 1	.....	6,250	.....	.....
	Specimen No. 2	.....	5,600	.....	.....

*Samples blistered and warped slightly.
†Samples blistered and swelled slightly.
‡Samples blistered and swelled badly.
+Indicates a number greater than that given.

TABLE IV—TENSILE STRENGTH OF MOLDED INSULATIONS

Class of Molded Insulation Tested		Pounds per Sq. In.
"A"	Specimen No. 1	2000
	Specimen No. 2	940
	Specimen No. 3	1090
	Specimen No. 4	1010
"B"	Specimen No. 1	1550
	Specimen No. 2	920
	Specimen No. 3	1285
	Specimen No. 4	1421
"C"	Specimen No. 1	2230
	Specimen No. 2	1985
	Specimen No. 3	2478
	Specimen No. 4	2918
"G"	Specimen No. 1	3020
	Specimen No. 2	4000
	Specimen No. 3	2920
	Specimen No. 4	3405
"G" (a)	Specimen No. 1	4750
	Specimen No. 2	3780
	Specimen No. 3	2880
	Specimen No. 4	3860

Class A (a)—Molded bushings, irregular shape, 3 in. by 2⅜ in. over all.

Class B—Cover, over-all dimensions 2⅜ in. by 2⅜ in. by 1⅜ in. high, width ½-in. wall.

Class B (a)—Caps for hexagonal nuts or bolts, maximum width of head 1 in., thickness of wall ½ in.

Class C—Plates 3¼ in. by 2½ in. by 5/16 in. thick, cut from one plate 5 in. by 7 in. by 5/16 in.

Class C (a)—Plates 3 in. by 3 in. by ⅜ in., cut from one plate 7 in. by 7 in. by ⅜ in.

TABLE V—DIELECTRIC STRENGTH OF MOLDED INSULATIONS

Class of Molded Insulation Tested		Volts per Mil with Samples Tested Under Conditions Below						
		As Received	After Immersing in Water for 72 Hours	After Subjecting to 300 Deg. C., Cooling and Immersing in Water 24 Hours	After Immersing in Transformer Oil at 75 Deg. C. for 72 Hours	After Subjecting to 100 Deg. C. for 12 Hours	After Subjecting to 200 Deg. C. for 12 Hours	After Subjecting to 300 Deg. C. for 12 Hours
"A"	Specimen No. 1	152	114	..	152*	87.7*	67.0†	¶
	Specimen No. 2	178	110	..	170*	91.1*	60.0†	¶
	Specimen No. 2	143	103	..	164*	86.0*	62.0†	¶
"A" (a)	Specimen No. 1	361	287	..	.....	.....	.....	.....
	Specimen No. 2	350	293	..	.....	.....	.....	.....
	Specimen No. 3	353	301	..	.....	.....	.....	.....
"B"	Specimen No. 1	91.8	53	80	193	90.0	98.0	96
	Specimen No. 2	83.5	58	78	169	84.0	101.0	105
	Specimen No. 3	88.0	55	83	188	91.0	96.0	102
"B" (a)	Specimen No. 1	167.0	121	..	.....	.....	.....	.....
	Specimen No. 2	148.7	118	..	.....	.....	.....	.....
	Specimen No. 3	159.3	107	..	.....	.....	.....	.....
"C"	Specimen No. 1	69.5	42	55	145	70.0	74.0	94
	Specimen No. 2	72.2	40	57	149	73.0	79.0	90
	Specimen No. 3	70.8	45	54	147	68.0	76.0	96
"G"	Specimen No. 1	46.2	40	..	30.3	65.7	102.5	¶
	Specimen No. 2	41.7	36	..	29.8	67.0	109.0	¶
	Specimen No. 3	45.0	38	..	31.0	63.0	101.0	¶
"G" (a)	Specimen No. 1	221	....	..	186	163.5	119.0*	¶
	Specimen No. 2	213	....	..	184	159.6	116.0*	¶
	Specimen No. 3	218	....	..	180	166.0	124.0*	¶
"G" (b)	Specimen No. 1	326	235	..	.....	.....	.....	.....
	Specimen No. 2	315	228	..	.....	.....	.....	.....
	Specimen No. 3	333	241	..	.....	.....	.....	.....

*Samples were blistered and slightly deformed after test.
†Samples were swollen up and entirely deformed after test.
¶Unable to test because of change caused by heat.

Class G—Plates 4 in. by 2⅝ in. by ⅜ in., cut from one plate 8 in. by 6 in. by ½ in.

FIG. 9—STRAIN INSULATORS MADE OF MOLDED INSULATION

Class G (a)—Plates 4 in. by 2⅝ in. by ½ in., cut from one sheet 8 in. by 8 in. by ½ in.

Class G (b)—Molded bushing 1⅝ in. by 1¾ in. over all.

Ohmic resistance tests were made first on these sam-

ples, which were afterward subjected to the high-tension break-down tests. The insulation resistance was measured by the usual high-sensibility series galvanometer method, the time of electrification being one minute.

Pressures ranging from 150 volts to 700 volts were employed, depending upon the value of resistance to be measured. The electrodes employed were containers, a guard ring being employed so that the question of surface leakage was thereby eliminated. After immersing an insulation in water and before testing its dielectric strength the excess surface moisture was removed with blotting paper. Since the samples were very small and the guard ring near the edge, it is probable that the leakage current after immersion was relatively large,

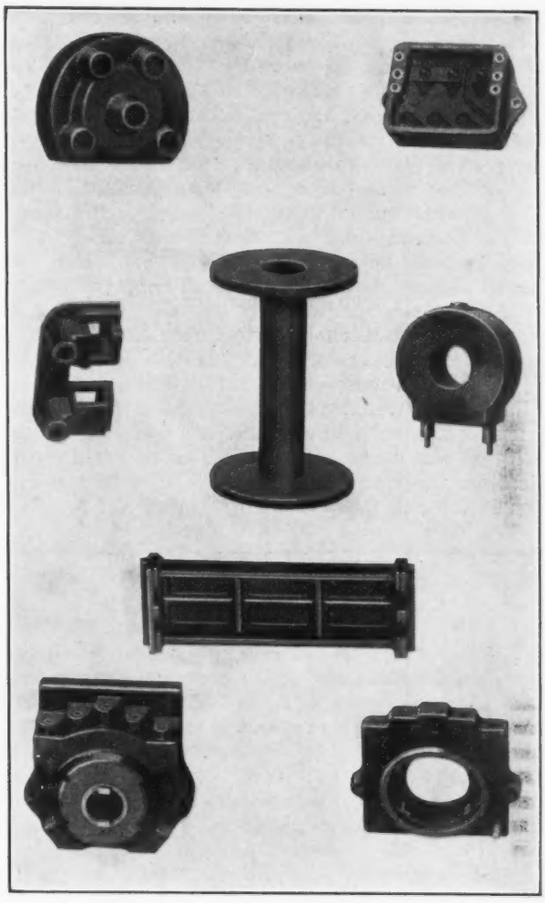


FIG. 10—MAGNETO PARTS MANUFACTURED OF MOLDED INSULATION

and the results must be considered of questionable value.

The dielectric strength tests were made with samples placed between blunt needle points. The impressed potential was initially low but was gradually increased until puncture occurred. The puncturing voltage was calculated by measuring the primary voltage of the step-up transformer used with a voltmeter and multiplying the reading by the transformation ratio. Sixty-cycle, practically sine-wave energy was employed in this processs.

Tensile-strength tests were conducted on samples in the form of standard briquettes like those used in cement testing. These briquettes were cut from blocks about 10 in. thick, and tests were made with a standard tensile testing machine. The total rating of this machine was 6000 lb.

Plant Betterments for the Ludlow Mills

The mills belonging to the Ludlow Manufacturing Associates, makers of twine, jute bagging and jute and linen carpet yarns, are situated along the bank of the Chicopee River at Ludlow, Mass. Water-power has been developed from the river for many years, but with the growth of the manufacturing plant the capacity of the earlier engines and waterwheels was exceeded and a central steam-electric plant was built. The next step was the development in 1901 and 1902 of a water privilege at Red Bridge, about 5 miles above Ludlow, and the transmission of energy electrically.

The erection of the so-called No. 11 mill in the present year will create an additional demand for power, amounting to about 2400 kw, when the mill is fully equipped, although only one-half of this rating will be required for the initial installation of machinery. The capacity of the power plants at present (aside from two waterwheel installations, the output of which is practically all utilized in adjacent mills) is 4575 kw for the Red Bridge plant and 2500 kw for the steam plant. These two plants are operated in parallel, and although

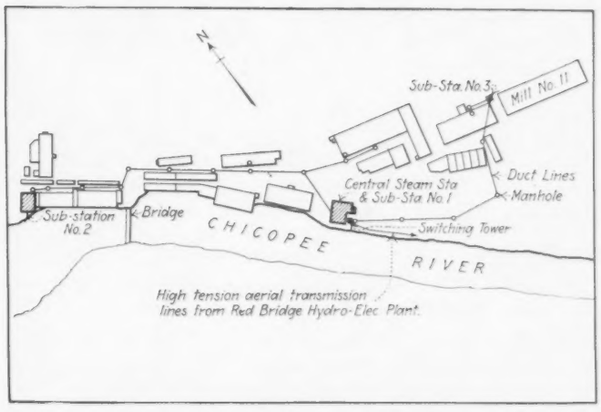


FIG. 1—LAYOUT OF LUDLOW GENERATING PLANTS AND SUBSTATIONS

with plenty of water in the river they could furnish all the power required, the reduced flow during several months of the year renders them inadequate.

In order to increase the generating capacity in the best way and at the same time to utilize as much as possible of the existing equipment, the owners decided to have an independent engineering report made on the entire power situation by Lockwood, Greene & Company, of Boston. Subsequently these engineers were retained to carry out their recommendations, made plans for enlarging the steam plant, and supervised its construction and equipment.

Existing Power System

The general plan of the distributing system at Ludlow is shown in Fig. 1. Three-phase, 40-cycle energy from the Red Bridge water-power plant is transmitted over a double pole line at 10,500 volts to a switching station in the mill yard, and from this station it is distributed at the same pressure by underground cables to the three substations.

Taking the substations in order, No. 1 is in the steam power house. Substation No. 2 contains transformers for reducing the pressure to 575 volts for the motor circuits supplying adjacent mills. Substation No. 3 is similar to No. 2 and is to have at first 1500 kva and ultimately 3000 kva of transformers for carrying the load of the new No. 11 mill. The lighting is handled by feeders connecting the substations to the 550/110-volt distributing transformers in the mills.

Substation No. 1, as already mentioned, is in the steam power house, and the low-tension terminals of its transformers feed the station busbars, thus affording a connection with the steam-driven generating equipment.

The present steam units consist of a 750-kw engine-driven generator, which is little used, and a turbo-al-

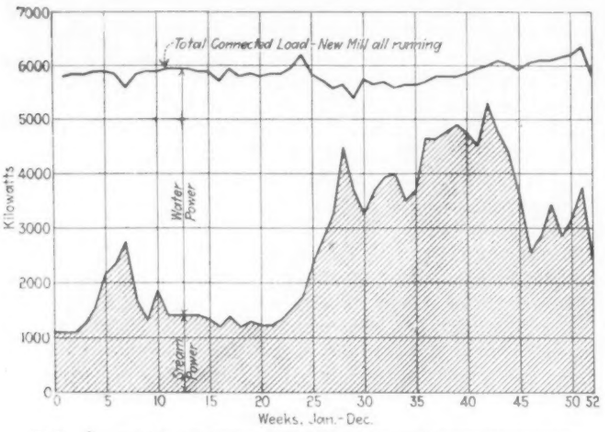


FIG. 2—LOAD CURVES OF LUDLOW MANUFACTURING ASSOCIATION

ternator rated at 2500 kw at 80 per cent power-factor. These machines operate in parallel at 600 volts. Excitation is furnished by a 23-kw and a 60-kw motor-generator and by a 20-kw steam-driven unit for starting.

The steam plant is run only as an auxiliary to the water-power station and is ordinarily shut down for most of the year. In periods of low water, however, the steam plant carries a preponderance of the load. Only under extreme conditions of drought is it necessary to run both steam units at the same time.

Determining the Size of New Equipment

In order to determine the proper size of the additional generating equipment, the load curves which are reproduced in Fig. 2 were plotted from the Ludlow records. The total power required for the entire plant from week to week, including an additional 2500 kw to represent the estimated power required for the new mill, is shown by the upper curve. The corresponding output of the water-power plant for the same period, including an allowance to represent surplus water which might be converted into electric power with the units already installed, is plotted on the same diagram in such a way that the power lacking at any time may be read off directly. The lower curve therefore represents the amount to be made up by the steam plant.

From a study of these curves it was evident that the hydroelectric power available at certain periods of low water when the entire new mill was running would be so small that the steam plant would be called upon for about 2500 kw more than its former maximum output, not counting upon the engine unit. Accordingly it was decided to duplicate the present 2500-kw turbine. Spare capacity is provided by the reciprocating unit, which only very rarely has to carry full load when the present 2500-kw turbine is running.

Three ways were considered for delivering the power of the new generator to the No. 11 mill, viz.:

1. To generate at 10,500 volts and connect with the high-tension system at the switching station.

2. To generate at 600 volts and transmit directly to Substation No. 3 at that voltage.

3. To generate at 600 volts and connect through transformers to the high-tension system at the switching station.

Features of the Three Methods

The first scheme appeared in some ways the most logical to adopt since the Red Bridge plant has a surplus generating capacity available when there is sufficient water. In such a case the new turbine would supplement the Red Bridge water-power at the same voltage with no transformer losses.

There were, on the other hand, several objections to this plan. In the first place, there was a power load of about 1800 kw, which would have to be supplied from Substation No. 1 at 600 volts. If the old units should fail and the new unit should have to be used for this load, there would be a transformer loss when running the new turbine. On account of the fact that the turbine would be somewhat special in character because of the 40-cycle system, the expense of such a machine for 11,000 volts would about equal the cost of a 600-volt machine with transformers. From the standpoint of cost, therefore, there was little choice. There was, however, some advantage in keeping the pressure the same as before on account of the familiarity of the operating force with the low voltage.

The second plan—to generate power and also transmit it at 600 volts—overcame the objection to high-tension generation, but required expensive low-tension cables for transmission. Furthermore, in order to utilize any surplus power from Red Bridge, such as is available at the switching tower during the greater part of the year, it appeared logical to increase the number of high-tension lines to Substation No. 3 and to reduce the voltage at that point. However, this called for a high-tension line parallel to a low-tension installation and would have resulted in a large idle investment, since both lines could not be used to their capacity at the same time. In order to avoid such a duplication, the transformers might be placed at Substation No. 1 and a low-tension cable to No. 3 utilized

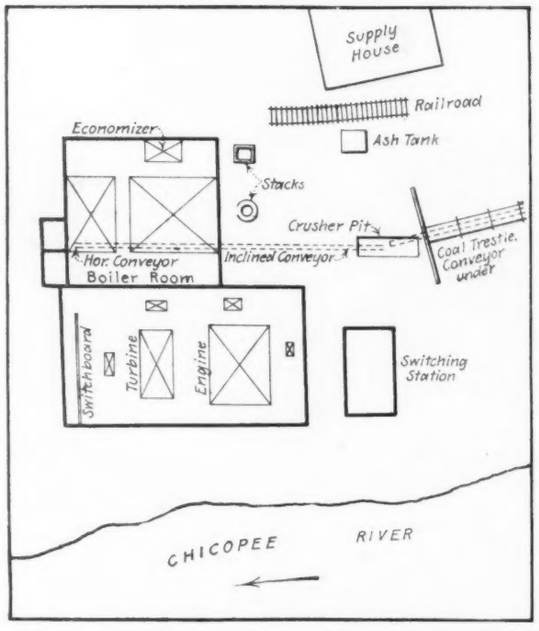


FIG. 3—ORIGINAL POWER PLANT OF LUDLOW ASSOCIATION

for obtaining energy from either source. If this were done, the system would be inefficient under any conditions, for whether the energy were coming from Red Bridge or the steam plant, there would be a considerable loss in the low-tension cables to Substation No. 3.

The third plan was the one therefore adopted, and it provides for generation at 600 volts and transmission

at 10,500 volts. This scheme combines the advantages of the others without their disadvantages. The generator voltage is low and the same as that of the existing units in the station. A large part of the load is distributed directly at the pressure of generation and the power transmitted to Substation No. 3 goes over the most economical line with a small initial transformer

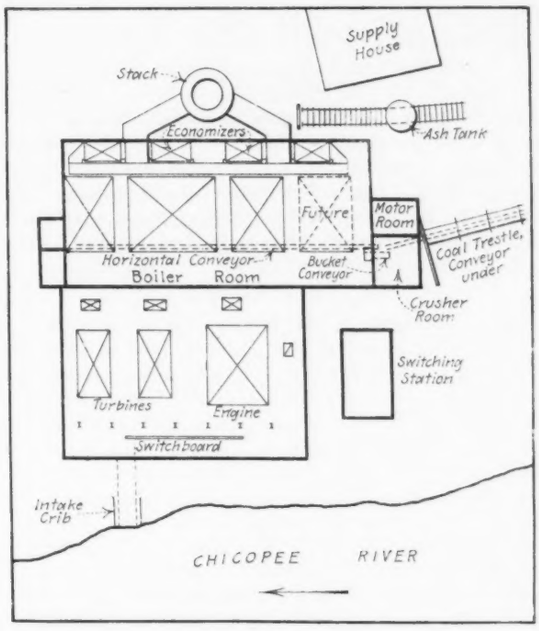


FIG. 4—REMODELED POWER PLANT

loss. The Red Bridge power is carried over the same high-voltage line with no initial loss.

New Electrical Equipment

The new electrical equipment for the power house comprises a 2500-kw turbine, a 60-kw motor-exciter, a twenty-one-panel switchboard and two 750-kva oil-insulated, self-cooling transformers. The turbine is rated at 2500-kw at 80 per cent power-factor, with a 40 deg. temperature rise, and has a continuous overload capacity of 25 per cent. The new motor-driven exciter duplicates a present machine and has sufficient output to excite both turbines simultaneously. The present 20-kw steam-driven exciter will be used for starting in case neither turbine is running and Red Bridge service fails.

The switchboard controls the two turbines, the engine-driven generator, four exciters, twenty-three feeder circuits and four banks of transformers. The old switchboard instruments were nearly all of the primary type. They have been reconstructed as secondary meters and will be used with instrument transformers on the new board. All the former main switches and automatic circuit-breakers have been retained, and about one-third of the feeder switches which formerly had fuses for protection have been replaced by automatic circuit-breakers. The two main turbine switches are of Condit make, electrically operated, and are located in the basement. For the new turbine a 4000-amp switch is used, and apparatus for electrical operation is being installed on the old switch.

The transformers are of the standard three-phase type, having been selected instead of the single-phase type on account of the rather limited space available in both Substations No. 1 and 3. The large number of transformer units installed in both substations made remote the possibility of serious crippling by the failure of an entire three-phase unit.

The new cables from the high-tension switching station to Substations Nos. 1 and 3 are of the three-conductor, varnished-cambric, lead-covered type manufactured by the Standard Underground Cable Company. The conductors are No. 2 B. & S. gage. The line to Substation No. 3 is laid in an underground conduit, and that to Substation No. 1 is placed in a new duct line of Orangeburg fiber conduit.

At Substation No. 3 two 750-kva transformers were connected with the high-tension line and six panels were added to the board to carry the motor-service and lighting feeders to the No. 11 mill. The size of this substation precluded the use of single-phase transformers, and since no attendant is required here the self-cooling type was very desirable.

Installation of Boilers and Turbine

Having decided upon the size of the new turbine, the next question was that of its supply of steam. In view of the fact that the steam plant serves merely as an auxiliary to the water-power and operates at full capacity for only a few weeks in the year, it has been customary at such times to run the boilers at 200 per cent of their normal rating, thus keeping down the investment in plant. In accordance with this practice, which has proved successful from an operating standpoint as well as a financial one, it was decided to install only one additional boiler at this time. The 680-hp size was selected, giving the plant four boilers of about the same capacity. These will supply steam enough at 185 per cent of their normal rating to run the entire steam plant at full load. With the largest boiler out of service the others will supply the same amount of steam at 255 per cent of their rating.

Having determined upon the sizes of the new units to be added to the steam plant, the next difficulty was to place them. As will be seen by referring to the plans of the buildings (Figs. 3 and 4), the only available space in the generator room was at the west side, and this was encroached upon by the switchboard. It was accordingly determined to move this board to a position in front of all the units, giving it a more central location with reference to the generators as well as removing it from the operating floor. For this

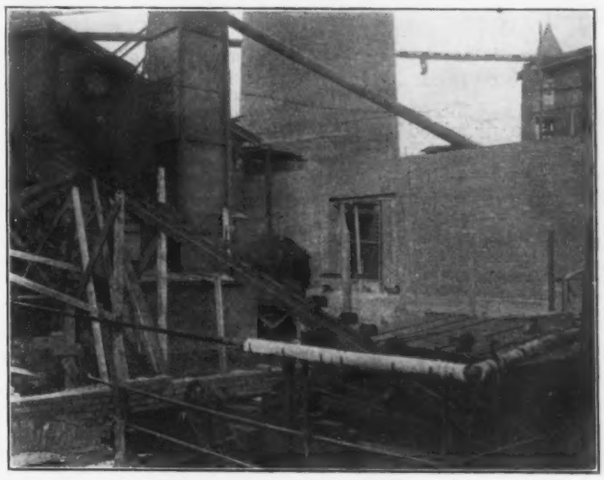


FIG. 5—BOILER HOUSE DURING RECONSTRUCTION

purpose the building was extended toward the south about 14 ft. This addition is two stories in height, the switchboard being on the second story on a level with the turbine room, while space is afforded in the basement for the transformers which were beneath the board in its former location.

In the space gained by moving the switchboard the

new 3125-kva turbo-alternator is to be installed. This machine is of General Electric make and operates on a steam pressure of 190 lb. per sq. in., with 125 deg. superheat. A Leblanc condenser, designed to give a 28-in. vacuum, is located in the basement.

Rearranging the Boiler Plant

The extension to the boiler house presented more difficulty than the changes in the generator room. As will be seen from the plan of the station as it was originally, two steel stacks and an induced-draft fan were situated at the east side, which would be the natural place to add new boilers in order to have a compact plant. Furthermore, coal was also received on this side through an inclined conveyor. It was finally decided to build a new chimney at the center of the north side of the boiler house and to rearrange the coal-handling apparatus so as to secure room for extension in the proper direction. The new chimney is of brick with a diameter of 10 ft. and a height of 250 ft. and has sufficient capacity to replace by natural draft the induced-draft fan and stacks formerly used and to provide for two additional boilers.

The removal of the old stacks being thus made possible, the boiler house was extended toward the east a sufficient distance to house two 680-hp boilers. This brought the new east wall close to the coal crusher, which was arranged to discharge into a vertical conveyor instead of an inclined one. In the extension of the boiler house one new 680-hp Edge-Moor boiler is to be installed at present, equipped with a Foster superheater and a Murphy automatic stoker.

Owing to the fact that the plant must be kept in operation every day during reconstruction, the work on the chimney was completed first, and all the work which would interrupt the operation of the plant was done at night and on Sundays.

The arrangement of the smoke flue and economizers deserves especial mention. On account of the limited space between the rear of the boilers and the wall, it was impracticable to increase the size of the flue for handling the gases from the new boiler, so a plan was worked out for dividing up the economizer surface into four sections of 200 tubes each, of which three sets are new. The fourth is the old set with eighty tubes removed to make it the size of the others. The travel of gases from each boiler to its economizer is very short and any section of the breeching has to handle the gases from only one boiler. By-pass dampers are provided so that any economizer may be cut out when desired. Two brick flues conduct the gases from the breeching to the chimney, both of them being provided with automatic dampers controlled by a single regulator to insure simultaneous action.

Fig. 5, which shows a view of the boiler house, indicates some of the difficulties overcome in enlarging the plant while in operation. The new brick chimney had to be finished before the square steel stack and its fan could be removed, and the coal conveyor was run until the building was ready for the new elevator.

Improving the Water Supply

The water for the condensers was previously drawn from the river in pipes, and the discharge from the Leblanc condenser attached to the turbine was returned to a concrete well in the basement. From this well the boiler-feed water was pumped, being passed through two closed heaters and returned to a standpipe in the well, from which another pump fed the boilers through the economizer.

Under the new arrangement a tunnel will bring cold water from the river into a new well in the basement, the intake of the tunnel being provided with suitable screens. The two Leblanc condensers will draw their injection water from the new well and will discharge into the old one. The overflow pipe from this hot well to the river has been provided with an elbow at such a height that the water in the well can never fall below a certain level. From this well the boiler-feed pumps draw their supply and force the water through a single closed heater to reach the economizers and the boilers.

The possibility of a failure in the supply of water to the hot well due to a stoppage of either condenser has been provided against by arranging a separate suction line from the feed pumps to the cold well. This line will be provided with a check valve which allows only warm water to be drawn by the feed pumps as long as there is a sufficient supply in the hot well. Should the hot water fall below a certain level, however, the check valve will open and automatically supply the feed pumps from the cold well.

Coal-Handling System

Coal is received in railroad cars and dumped from a trestle for storage on the ground. Underneath this trestle runs a conveyor which carries the coal to crushing rolls at the end of the new boiler house. From the rolls the coal passes to a vertical overhead conveyor, which discharges through a weighing hopper to a horizontal overhead conveyor in the boiler house. This latter conveyor discharges to the hoppers of the stokers.

Ashes are removed by the Darley suction system, installed by the Guaranteee Construction Company. This consists of a horizontal pipe underneath the furnaces, with an opening at each ash pit into which the ashes are raked. The pipe discharges into an elevated tank just outside the boiler house, underneath which is a railroad track so that the ashes can be removed in cars.

Garaging, Charging and Loading Delivery Trucks

Lord & Taylor, proprietors of New York's newest and one of this country's most completely equipped department stores, have ordered forty-four electric and ten gasoline trucks, which will replace over 100 horse-drawn vehicles now employed in the firm's delivery service. Innovations have been made in the methods of loading, charging and garaging these vehicles.

The delivery department and truck-loading platforms are in the store basement, to which access from the street level is made possible by an inclined driveway extending in a loop under the entire store. While the trucks are being loaded the batteries can be given a short boost from charging plugs installed at each loading platform. The drives have been laid out sufficiently wide to prevent congestion and also to serve as garage space. Washing, cleaning, battery charging and other garage work can be performed in these passageways after delivery hours. Most of the batteries are of the Edison type, and to these will be given constant-potential charges. More attention will be paid to the method of charging the lead cells. By garaging the trucks in the loading driveways time will be saved which would otherwise be wasted in running between the store and a separate garage. Energy for charging the batteries is generated in a private plant in the sub-sub-basement.

The General Vehicle Company is furnishing forty-one electric trucks, of which thirty-nine are designed for 1000-lb. loads and two are rated at 2 tons each. The other three vehicles, rated at 1000 lb. each, were furnished by the General Motors Truck Company and the Commercial Truck Company of America.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods and Current Practice Among Successful Utilities

Electrical Salesmanship in Chicago

At a largely attended meeting of the contract department of the Commonwealth Edison Company of Chicago held in the assembly room of the Western Society of Engineers on March 10 Mr. E. W. Lloyd, general contract agent, made the interesting statement that the net contracted business of the company was nearly 70 per cent larger on the date mentioned than a year ago. Mr. Louis A. Ferguson, vice-president of the company, was the principal speaker of the evening, his subject being "Salesmanship."

Inter-Departmental Information Among Central-Station Employees

Following the policy of having a number of very short papers and brief discussions from representatives of the various departments of the company for the benefit, largely, of the men in the other departments, the Commonwealth Edison Company Section (Chicago) of the National Electric Light Association listened to six papers at its meeting of March 26. The titles of these papers and the names of the authors are as follows: "Stores Accounting," by Mr. Charles Marden, stores department; "Stores Claims," by Mr. E. J. Callahan, stores department; "Customers' Repairs," by Mr. J. N. Walton, customers' repairs department; "Interior Wiring," by Mr. James J. Kelgallon, construction department; "Interior Wiring," by Mr. B. E. Roffee, construction department; "Station Construction," by Mr. C. B. Crothers, construction department. Among those taking part in the discussion were Messrs. H. E. Addenbrooke, George Nelson, J. T. Doyle, R. H. Williams, J. J. Kelly, John Burkhardt, C. H. Ibsen and O. R. Hogue. Various entertainment features, as vocal solos, singing by a quartet, a saxophone solo, a vaudeville sketch, etc., were enjoyed.

In compact compass much useful information was conveyed in these short papers and the discussions. A few of the facts brought out may be repeated as of general interest. Thus, the customers' repairs department received 29,000 calls in the year 1913. The work of this department is divided into three classes; that is, general repairs, repairs on heating devices, and the installation and removal of lamps and meters. The construction department employs 656 men. The city is divided into seven general districts for the operation of this department, each district in charge of a general foreman. In doing interior wiring the department makes allowance for future increases in load. Unlike the situation in the case of the outside contractors, the relations of the company doing the wiring work and the customer are just beginning when the job is finished; therefore, the work must be done carefully and thoroughly with regard to the future. One important feature of the work of the construction department in recent years has been the rehabilitation of service connections under sidewalks in the central business district. In many cases this wiring, by frequent additions and changes, had become complicated, confusing and unsightly. The construction department also installs all apparatus in substations and in the generating stations, except in the case of turbo-generator units. In consequence of the varied experience that Chicago gives, the employees of the construction department are in demand elsewhere. About twenty-five former employees are connected with the electrical engineering and construction work on the Panama Canal. There is a great deal of overtime work in this department, as often machinery or apparatus can be overhauled or handled only at certain hours in the night. Sometimes the men get paid for as much as ninety hours' time per week, including overtime.

Early-Morning Demonstrations of Preparing Breakfast

The New York Edison Company recently gave several early-morning window demonstrations of cooking breakfast by electricity to suggest to people hurrying to business how much quicker and more convenient the electric method is than any other. Griddle cakes were cooked on electric grids, grilled lamb chops were prepared on broilers, breakfast cereals were cooked in double boilers heated by electricity, biscuits were

CENTRAL-STATION WINDOW IN WHICH BREAKFAST WAS PREPARED

baked in electric ovens, and coffee was brewed in percolators. After the food had been prepared it was arranged in a tasty manner where it could be seen by people passing the window later in the day. The accompanying illustration shows the central-station window display when this demonstration was being conducted.

Pensions for Old Employees of Baltimore Company

After long service the following employees have been retired and pensioned by the Consolidated Gas, Electric Light & Power Company, of Baltimore Md.: Mr. Robert Wright, forty-one years' service; Mr. Robert J. Korr, forty years' service; Mr. William H. Gallagher, thirty-seven years' service; Mr. Jacob H. Griffin, thirty-six years' service, and Mr. John Rodgers, twenty-one years' service. The system of retirement now employed by the Baltimore central station was planned by President J. E. Aldred and has been found to exert an excellent effect. The five men recently retired on pensions have been also put on the company's roll of honor and were recently presented with silver medals in token of their long careers of usefulness and fidelity.

Electric Moving Van

The Hebard Sheridan Road Storage Warehouse of Chicago claims to have the only electric moving van in that city. A picture of this ponderous, conspicuously lettered and rather interesting vehicle is shown herewith. Evidently, even if the van did nothing else it would have considerable value as a moving signboard.

MOVING VAN WITH ELECTRIC DRIVE

The truck was made by the General Vehicle Company and is equipped with an A-10 Edison storage battery and a General Electric 3.5-hp motor capable of driving it from 45 miles to 50 miles on a seven-hour to ten-hour charge. The battery consists of sixty cells in five trays and the normal charging rate is 80 amp at 120 volts. It is charged every night; in fact, the aim is to keep the battery charged at all times. The van is capable of carrying a load of 7000 lb. The inside measurements of this "room on wheels" are 6 ft. wide, 7 ft. high and 13.5 ft. long. The tail-gate adds an additional 4 ft. of length when lowered.

In response to a request for information about the actual operation of this interesting electric truck, the Hebard concern reports that it costs about 10 cents a mile for energy to operate the van. It is said to be almost impossible to make a statement as to the actual cost, as road conditions have so much to do with the mileage obtained. Much depends upon the driver. Some men will get a great deal more out of the battery than others. The hauls of the Hebard electric moving van average about 30 miles and its longest trip was 58 miles. It is the practice of the Hebard people to use their gas cars for hauls in outlying districts or on country roads. The electric van is used on well-paved city streets, not on the soft country roads.

There are so few moving parts on the electric van that its upkeep is reported by its owners as practically nothing compared with that of gas cars. In operation the electric van has several good points. One of these is that the average driver of a gas truck is not apt to stop his engine every time he stops his car, whereas the driver of the electric van has to shut off his energy to stop the car; in other words, with the electric van the expense stops when the car stops, while with the gas car the engine may be left running while the van is standing still. At such times the gas engine is running slow, of course, but nevertheless there is some expense, some wear and tear, and, most damaging of all, the vibration is going on all the time.

Operation of Line-Construction and Installation Truck

The Commonwealth Power Company, Jackson, Mich., which has replaced its horse-drawn installation and line-construction wagon by a 1-ton General Motors truck, submits the following figures on two months' operation of that vehicle:

Working days in use	51
Miles traversed	923
Energy for charging, in kw-hr	982
Charging expense at 3 cents per kw-hr. (public garage rate)	$29.46
Garage labor	3.61
Miscellaneous supplies, etc	6.57
Total	$39.64
Cost per mile	0.04
Operating and maintenance charges per working day	0.78
Expense of team and man replaced per day	4.50

The work now being accomplished with the electric truck formerly required a team of horses and a driver. Now the foreman of the line-construction squad operates the truck, and as much work is being performed by four linemen as was formerly done by six, owing to the saving of time in traveling to the job.

The Real-Estate Office as a Lighting Customer

In many cities real-estate offices are nightly kept open for business for some time after the evening peak load. The demands for first-class illumination, of both the general and special types, are considerable in these realty premises. Standards are being raised and the fittings of the best establishments are approaching those of banking houses. In some large offices the geographical subdivision of the duties of employees suggests the use of transparencies, motor-operated office appliances and localized billboard lighting on a larger scale than in very small establishments, although even the latter call for 60-watt and 100-watt units in general interior lighting. Sign and window lighting are important accessories, and in the suburban real-estate office the surrounding standards of lighting are often so inconspicuous that a first-class installation returns more than usual interest on the investment. Moreover, the demand for service is practically constant six nights a week. In some offices models of houses built for sale upon specially advertised terms are effectively lighted by miniature lamps, and there is almost no limit to the possibilities of window displays in the efficient lighting of photographs of properties for sale and to rent, border lighting, talking signs and transparency illumination. In this field the central-station man can do much to arouse the interest of discriminating people and to give a tone to the local office which is an important factor in drawing high-class patronage.

Persistent Soliciting Brings "White-Way" Results

Since September, 1912, the Union Electric Light & Power Company, St. Louis, Mo., has had a goodly number of solicitors devote their entire time to selling a "white-way" tungsten incandescent lamp designed especially to compete with the so-called "gas arc" lamp

FIG. 1—LIGHTING BEFORE ELECTRIC-SERVICE COMPANY'S OFFICE

used for both interior and exterior illumination. According to the terms of the contract under which the lamps are sold, customers may either buy the lamps outright or purchase them on an instalment plan by the terms of which payments are distributed over five months. For an additional dollar per month the electric-service company will renew the lamps and clean both lamps and fixtures at least once a month. Energy is sold on a meter basis.

The design of the outdoor fixture is shown in Fig. 1. With these units equipped with 500-watt lamps and

FIG. 2—A STREET WELL LIGHTED WITH "WHITE-WAY" LAMPS

suspended at a height of 12 ft. above the street, the light distribution covers the sidewalk within a radius of 15 ft., giving about 6 ft.-candles beneath the lamp, which gradually diminishes to 1 ft.-candle at the outer edge of the 30-ft. circle. Indoors the fixtures are suspended from brass bases by means of chains instead of the iron pipes shown in the illustrations.

Records of the sale of these lamps compiled during the latter part of January show that there now are in operation more than 5000 units. Another interesting compilation made shows the tendency of customers to use an increased amount of light as time goes on if it is available. For instance, an average of 101 representative customers' bills over a period of from two to five months in 1912 showed that these patrons had used 64,774 kw-hr., while a like average taken under similar conditions for 1913 showed that 83,089 kw-hr. had been used. These data show that energy consumption for these customers had increased 22.04 per cent in one year owing to longer use of lamps and increased voltage.

Motorcycle Repair Men in Columbus

Motorcycle repair men in the trouble department of the Columbus (Ohio) Railway & Light Company care for the small repairs necessary in the customers' homes. The fact that one of these men is able to make an average trip and arrive at the home of the customer fifteen minutes from the time the call is telephoned to the office gives the customers confidence in the service. The headquarters of the repair men are in the same building with the meter department just across the alley from the new-business department. Men of the latter department say that the service rendered by the motorcycle men is invaluable in producing satisfied customers. Twenty-four-hour service is given by the motorcycle repair corps.

Electric Refrigeration in the Florist's Shop

BY SYDNEY F. WALKER

In England extensive use is made of artificial refrigeration to enable certain flowers to be kept ready for table use all the year around. An example is the lily-of-the-valley, which may be seen on display in English shops every month out of the twelve. One seed merchant in Birmingham recently told the writer that he had lilies-of-the-valley, and a good quantity of them, on his dining table the whole year, except during a few weeks before Christmas. This he accomplished by cold storage as follows:

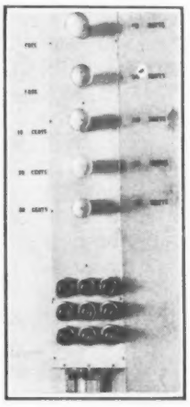
When the "crowns" of the lilies, as they are called, are just beginning to shoot, the plants are taken up out of the ground and placed in cold storage. They may be kept at any temperature which is convenient. The effect of the low temperature is to retard the development of the plant without injuring it. In the United Kingdom large quantities of such "crowns" of lilies-of-the-valley are thus kept in cold storage, being taken out in batches as they are wanted. After being removed from the low temperature the plants are placed in the ground out of doors, when the season is favorable, and when not, in soil in ordinary pots in the greenhouse, or in moss in vases. In any case the plants bloom in from three weeks to a month from the time of being taken out of cold storage. A number of other plants, principally lilies, but bearing no relation whatever to lilies-of-the-valley, are also grown from bulbs. These include lilium auratum, lilium lancifolium and the like. Their bulbs are also kept in cold storage and are taken out when required. Placed in pots or in moss, they then bloom at various periods. Some of the lilies bloom in five weeks, others take twelve weeks. It will thus be seen that it is only a question of arranging an advance schedule in order to have any of these plants that can be cold-stored in bloom at any time of the year.

In addition to the foregoing the florist adopting cold

storage has at his command a method of retarding the blooming of plants in actual growth. It sometimes happens that flowers are wanted for a certain day to exhibit at a show, or for decorating on some special occasion. Owing to the vagaries of the weather, the plants may perhaps come forward too rapidly, so that their blooming period is over before the time they are required. By placing them in cold storage for a little while the development of the plant is retarded, and they can be brought out again before the occasion for which they are required and allowed to finish their blooming.

Putting Lamp Renewal Prices on the Wall

At the office of the Hartford (Conn.) Electric Light Company the renewal prices of lamps are painted on the wall beside the exchange counter, as shown in the accompanying photograph, the corresponding lamps being wired to receptacles set into a wooden box, 7 ft. high, 8 in. wide and 3 in. deep, and equipped with individual snap switches near the lower end. The lamps range in size from 500 watts to 15 watts, and the posting of this oft-desired data in black letters ½ in. high, combined with the lamp display, saves much time for customers and clerks. The arrangement of the lamps in a vertical row greatly increases the legibility of the display throughout the office area and is a factor in attracting inquiries regarding electric service in general. The method may be found of use elsewhere.



LAMP RENEWAL PRICES ON WALL

Finding a Market for the Waste Products

Finding that the main objection to installing motor drive with central-station energy in the woodworking plants at Toledo, Ohio, lay in utilization of shavings and waste material as fuel for the boilers, the motor-service salesmen of the Toledo Railways & Light Company set out to find a market for this waste product. Calling fifty-five feed barns, livery stables, coal dealers and small grocers on the telephone, it was found that these small dealers paid 25 cents a load for shavings and would willingly pay 15 cents a load at the mill. Further investigation showed that approximately eight carloads of shavings were shipped into the city during the course of the month to supply these dealers. With these arguments in hand the motor-service solicitors are now approaching the owners of the thirty woodworking factories in the city with an argument to refute the "by-product waste argument" which has been raised by the woodworking plant owner in the past.

The Electric Furnace as a Load Builder

Recent investigations conducted by Mr. R. A. McGregory, of the Doherty Operating Company, 60 Wall Street, New York, have brought out data regarding the electric furnace as a builder of central-station load. In the city where the investigations were conducted the central station has an annual output of approximately 2,336,000 kw-hr. This energy is delivered at 33.33 per cent load-factor, the maximum demand being approximately 800 kw. It has been estimated that the fifty electric furnaces of 45-hp rating each, operating 6600 hours a year in a factory, create a maximum demand of 1687 kw and consume 11,137,500 kw-hr. Combining these two loads the central station's annual output would be 13,437,500 kw-hr. delivered at 61.8 per cent load-factor. Thus with an increase of but a small amount of generating equipment the station's annual output would be increased five times.

Investigations conducted by Mr. McGregory show that the electric furnace is practicable for forge fires, riveting, annealing and hardening, where operations are conducted between 1200 deg. and 2300 deg. Fahr. Oil and gas furnaces are at present the main competitors of the electric furnace, but investigations tend to show that their upkeep is higher than on the electric furnace.

Flat-Rate Wiring Campaign at Columbus, Ohio

A wiring campaign in which prospective customers are offered a complete wiring installation of eight outlets, together with fixtures, glassware, pull-chain sockets and 40-watt lamps, for $49.45, has recently been inaugurated at Columbus, Ohio. The campaign is designed to interest the man with a medium-sized house in which eight outlets will supply sufficient service. Co-operation of the Columbus contractors has been secured, and if a prospective customer expresses a desire for more than eight outlets an estimate under the terms of the company's standard wiring contract is given to him. To allow the company's salesmen as well as its advertising to approach prospective customers with a direct statement "We will wire your home for $49.45" is the principal idea of the campaign. Payments may be made on the instalment plan.

Under the direct supervision of Mr. W. A. Wolls, manager of the new-business department, much publicity is being given to the company's efforts through newspaper advertising, street-car posters and advertising appearing on theater programs. Additional solicitors have also been added to the regular force, as personal solicitation is depended upon to follow up all inquiries and ultimately to close the business.

CHRISTOPHER COLUMBUS OF COLUMBUS, OHIO

Taking a hint, perhaps, from the New York Edison Company, the Columbus Railway & Light Company features in its advertising the "at-your-service" man shown herewith, substituting the Genoan features of Christopher Columbus for the courtly figure of Father Knickerbocker so familiar to New Yorkers and to visitors to the metropolis.

Illumination and Wiring

Shadows of Natural and Artificial Light

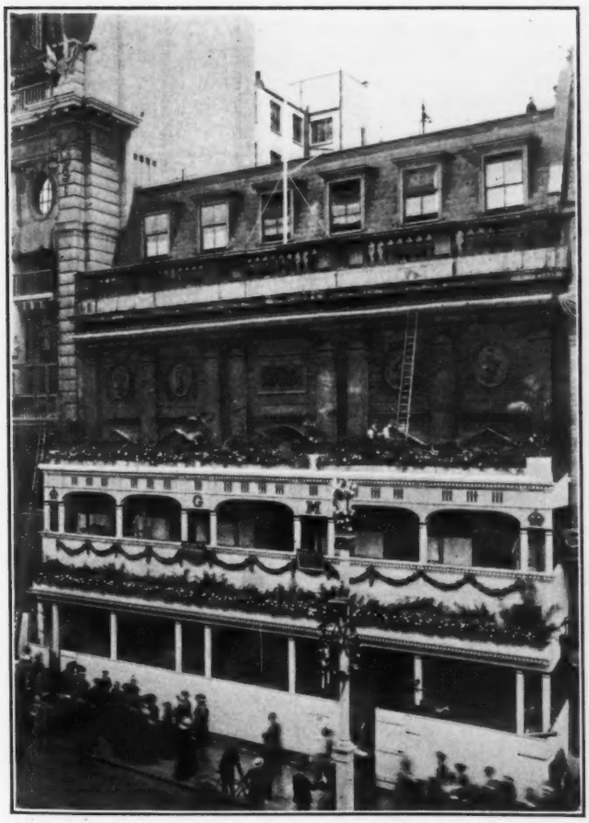
BY J. S. DOW AND V. H. MACKINNEY

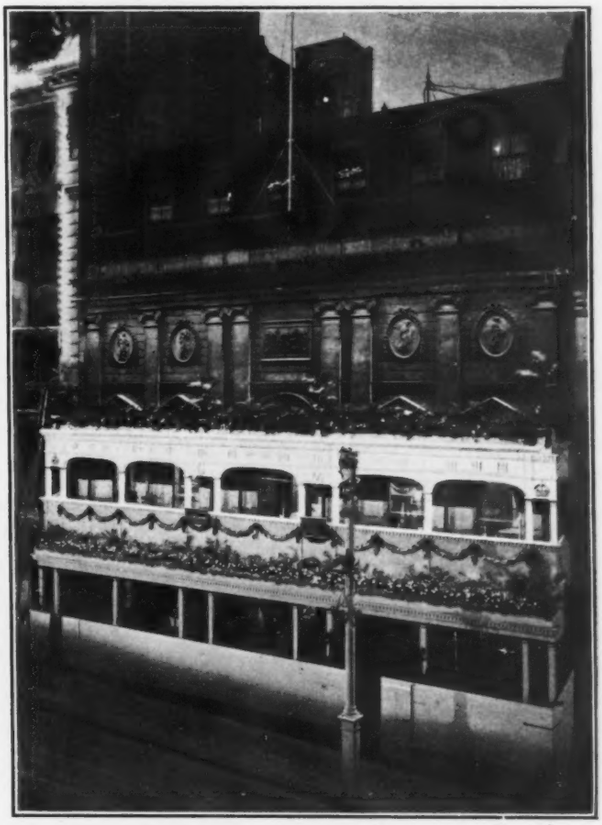
The subject of shadows by artificial light has as yet been only very imperfectly explored. Mr. M. Luckiesh, of Cleveland, read a paper on the subject last year, pointing out the importance of their effect in connection with carving and sculpture, and a few other references have been made from time to time. But there seems still to be much uncertainty as to the best method of attacking the problem experimentally. Photometric measurements have sometimes been employed. For example, it has been proposed to estimate the general character of the diffusion of light in a room by means of photometric determinations of the surface brightness in the brightly illuminated parts and also in the deepest shadow. The ratio between these two values might serve as a rough criterion. There is something to be said for such a method, but it does not record the degree of "softness," that is, the manner in which the density of the shadow diminishes toward its edges. Nor does it give any information as to the shape of a shadow, which can naturally only be represented pictorially.

Good photographs taken by artificial light often furnish an exceedingly useful method of portraying shadow, and in a recent paper before the (British) Illuminating Engineering Society in London the authors showed a number of illustrations of this kind. On the other hand, it must, of course, be recognized that, however conscientious the photographer, a photographic print cannot, in many cases, show *exactly* what the eye sees. For example, experience shows that in the average print one cannot expect to get a greater tone ratio than about thirty to one, and in most cases it is less. Yet in the actual view to be photographed there may be objects whose relative brilliancy far exceeds this. Consequently a photograph, while giving a correct impression as to the general nature of shadows, may not truly represent the gradation in tone. On this point more will be said later.

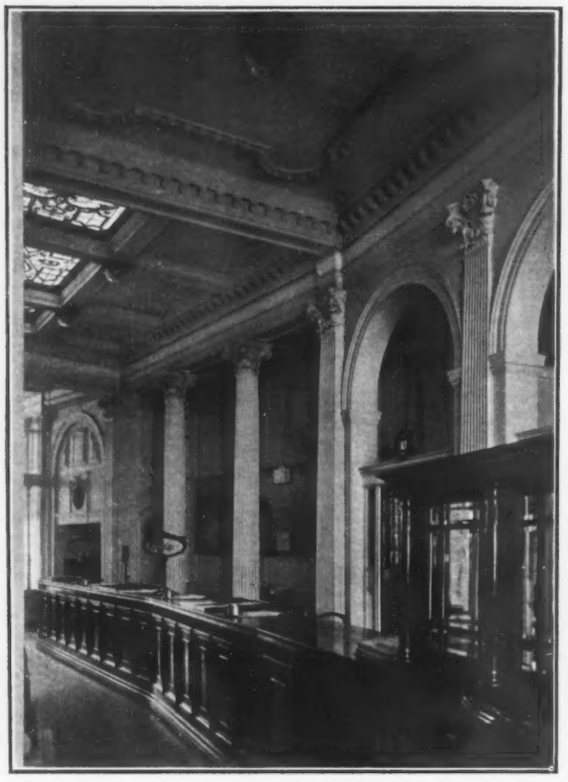
In this article it is proposed to discuss a few of the most typical examples of practical cases in which shadow is of importance and to illustrate these by a few photographs shown on the occasion referred to above. For example, Figs. 5 and 6 contain views of the same room, illuminated in turn by indirect lighting and by a bare lamp. The difference in the shadows in the two cases represents the extreme conditions likely to be encountered in practice.

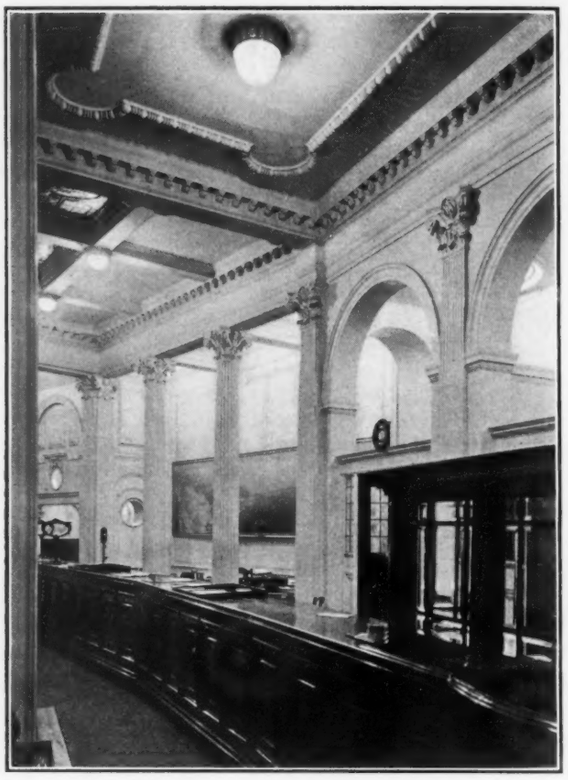
It will be readily appreciated that there are many cases in which good diffusion is very vital, particularly in connection with industrial lighting. As a rule (but not always) one desires to have light coming from a number of different directions so that the objects in the room are illuminated on all sides. This seems really needful in order to see an object clearly and is probably essential to proper stereoscopic vision. The reflection from light walls and ceilings in a room is chiefly valuable on this account. It is not only that the amount of light reaching the working plane is greater, but the fact that the reflected light from the walls and ceilings comes at many different angles, so that the shadows cast are necessarily soft, makes the illumination considerably more useful. With a well-diffused illumination there is much less likelihood of inconvenient shadows being cast by a worker when bending over the job, or of troublesome shadows being cast by the hand owing to improperly placed lamps. Moreover, light reflected from a good white ceiling is able to penetrate into corners and recesses, so that with a well-diffused system of lighting it may be possible to see underneath bulky objects or into complicated machin-





FIGS. 1 AND 2—VIEWS OF WHITE'S CLUB, LONDON, ENG., TAKEN BY DAYLIGHT AND ON CORONATION NIGHT.





FIGS. 3 AND 4—VIEWS TAKEN BY DAYLIGHT AND ENTIRELY BY ARTIFICIAL LIGHT RESPECTIVELY

ery, when with a system giving very sharp shadows it might be difficult to do so.

Another point that is not always appreciated is the part played by the size of the room. Data for calculating the effect of reflection in rooms with walls and ceilings "dark, medium or light" are often given, but it is not always sufficiently recognized that the distance away of the reflecting surfaces makes a great difference in their practical utility. This is one of the great distinctions between most indoor and outdoor lighting. In the streets the objects illuminated are so comparatively far distant that the shadows are usually sharp, and in the case of rapidly moving vehicles this may confuse the pedestrian. But, in addition, the fact that surrounding objects are not, as a rule, lighted from many different directions makes it difficult to distinguish them as satisfactorily as by daylight. For example, it is often difficult to recognize acquaintances in the streets by night, even when the local illumination is very powerful. The reason is that the face is frequently strongly lighted up in parts, but other portions are left in partial shadow. Again, the mere facts of the majority of objects (houses, etc.) being comparatively far from the sources of light and being as a rule dark in tint also tend to make the effect of the light less distinct than it would be indoors. Anyone who has had the experience of trying to light a large barrack-like interior, such as a drill hall with dingy walls, will appreciate these points.

In the great majority of instances, therefore, we meet in practice a demand for well-diffused illumination, and light coming from one direction only would be considered quite unsuitable. On the other hand, there are instances in which such "unidirectional" lighting is just what is required. For example, the value of the beam from a motorist's head-lamp lies not alone in its intensity, a factor of equal importance being the oblique inclination at which the rays of light strike the road surface, showing up every little inequality in the roadway. An excellent instance was also recently encountered in a printing establishment. In many departments—for example, in the packing and dispatching rooms and to a great extent in the machine room—general diffused lighting is the rule. But an instance of unidirectional lighting is afforded by the sloping board on which the "lay-off" sheet is placed for examination when it comes off the machine. When this trial sheet is removed from the machine it is necessary to examine the impression very closely in order to insure that the pressure is exactly right. Otherwise the type would press too much on the paper and would show through on the reverse side of the page. Now, in order to show up these irregularities in the surface what one requires is light striking the paper very obliquely. In this case the printer, therefore, arranged the paper on a sloping board and placed an adjustable shaded lamp near one extremity so that the more remote parts of the paper were lighted by slanting rays and every little projection was clearly shown up. If one were to use vertical illumination, these irregularities would not be seen nearly so clearly.

In the same way anyone examining deliberately a sample of paper will hold it in a slanting manner so that the light strikes it very obliquely and shows up small irregularities in gloss or texture. But to a person reading a book in the ordinary way these conditions, which show up defects, are exactly what he wishes to avoid. The advantage of good diffusion, enabling light to strike the page from many different directions, is therefore appreciated by the reader.

Indirect lighting has often been recommended on the ground that it reduces the troubles arising through glare from shiny paper to a minimum and is therefore pleasant for reading purposes. But it is a matter for consideration whether for this very reason it is not unsuitable for the illumination of showrooms and workshops in which cloth of varying texture is dealt with. For in examining knitted goods, broché silk and similar

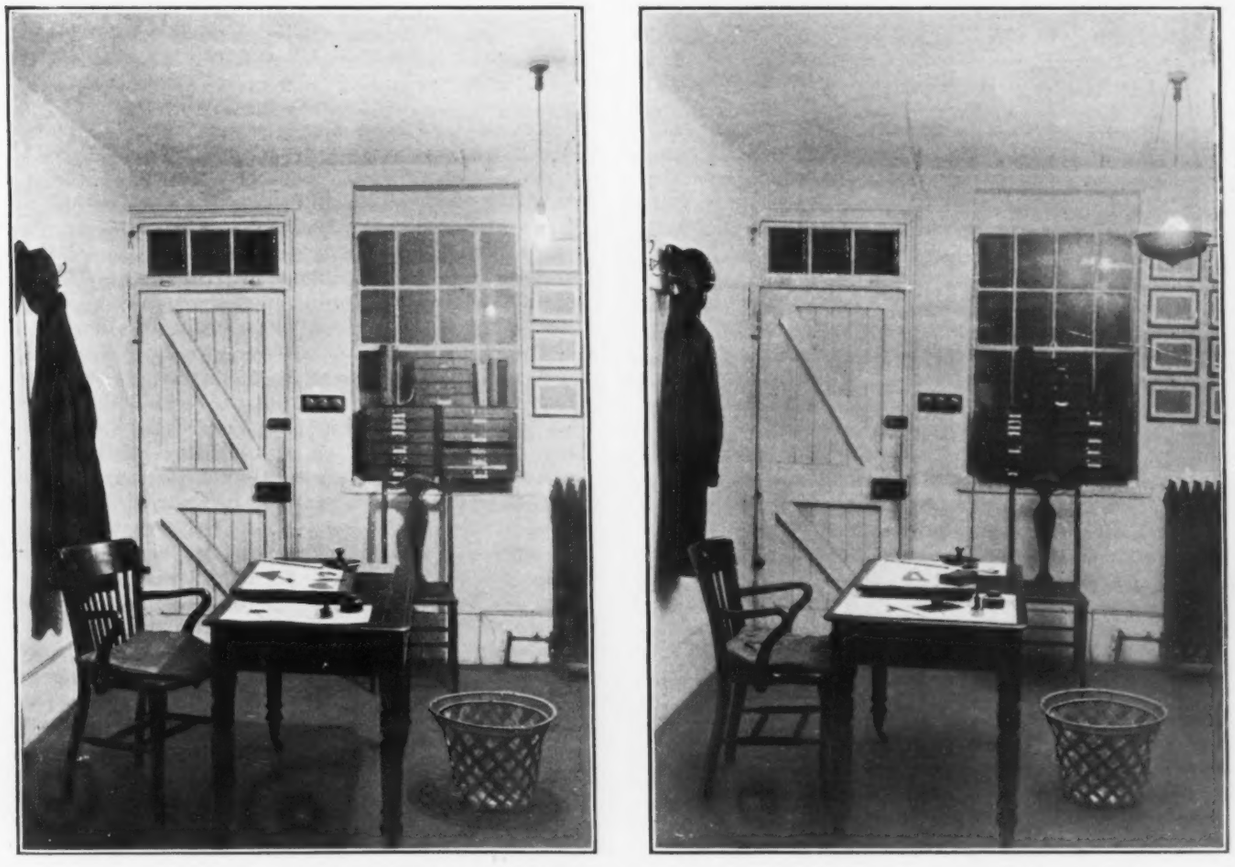
materials one is really guided by the observation of small irregularities in the surface, and it seems conceivable that a very soft illumination might not show these up in the same way as a system giving fairly dense shadows. It is a curious fact that people who have to do a great deal of sewing seem to prefer a local light. This may be due to the fact that they usually secure a greater illumination by this means, and that they find the local system of lighting favorable to mental concentration. But is it not possible, also, that the explanation may lie partly in the fact that a worker using a local shaded lamp can readily twist the material about and so, by altering the angle at which the rays of light strike it, more readily perceive differences in texture?

A somewhat similar point arises in connection with the display of highly polished materials, jewelry, silver, china, etc. The charm of such objects depends to a great extent on the reflected images on their polished surfaces, and one would suppose that, in order to produce this "sparkling" effect, sources having a fairly high intrinsic brilliancy should be used. It is probable that pure indirect lighting would give a somewhat flat effect. Similarly, in stores devoted to fancy goods, silks, velveteens and materials having patterns of a glossy nature on a matte ground, light coming from very large and evenly illuminated surfaces, such as occur in indirect lighting, might not be quite proper. Such conditions of illumination tend to blot out the inequalities of reflecting power and to reduce the entire surface to a dead level of "matte-ness." The authors have carried out a series of experiments on such materials in small booths and the results certainly seemed to justify this view to some extent.

The desirability of directional lighting comes in for consideration in the case of rooms having friezes in relief. In order to show up such friezes satisfactorily, or to display wallpapers with embossed patterns, light coming from all directions is not suitable. A certain general illumination may be desirable, but superimposed over this one may require special local lighting in order to produce a striking effect. For example, in the hall in the Savoy Hotel, London, the general lighting is by semi-indirect units, but in addition to this concealed local lamps are used at the base of the white frieze and are considered expedient in order to show up the figures clearly.

Another case in point is illustrated in Figs. 1 and 2, which show two photographs of the front of White's Club in London, taken respectively by natural and artificial light. The wording under the pictures explains sufficiently the nature of the concealed lighting, producing the contrast in the appearance of the front of the club. It will be seen that the carving and medallions are much more prominent features when lighted artificially by the oblique rays than they are during the daytime. Architecturally this point is an interesting one. It has sometimes been argued that these unusual light effects, being entirely distinct from those encountered by daylight, are unnatural and not in good taste. But surely it might be reasoned that in any case artificial light is something quite different from daylight—something new—and should not be treated in the same way or expected to give the same results. On the contrary, it would be much more logical to say that in artificial light we have something far better under control than daylight and capable of producing entirely novel effects, and that it is therefore quite legitimate to use this light to produce new effects, provided that they are pleasing and artistic.

The two interesting illustrations reproduced in Figs. 3 and 4 suggest another point for the consideration of



FIGS. 5 AND 6—VIEWS OF ROOM WITH LIGHTING FROM BARE LAMPS AND WITH INDIRECT LIGHTING

FIGS. 7 AND 8—VIEWS OF HOUSE TAKEN IN FULL DAYLIGHT AND AT DUSK RESPECTIVELY

the architectural profession, the difference in appearance of many interiors by daylight and by artificial light. This building interior, which is the office of the Allan Steamship Company in Cockspur Street, London, was selected because it illustrates so strikingly the curious reversal of shadow that so often occurs by artificial light, and also because it is in itself a most pleasing interior. The interesting point to notice is that the chief features are entirely reversed, the pillars, which appear light against a dark background in the daytime, appearing dark against a light background at night, owing to the concealed lamps above. It may fairly be claimed that the effect of the interior by artificial light is distinctly the better one. The contention has been made that buildings of any architectural pretensions are invariably designed with a view to their being seen by daylight, and in fact architects in most cases seem to take little interest in their appearance when illuminated artificially. Yet as a matter of fact the possibilities of design by artificial light would seem to be very great, and the combination of the architect's art and the illuminating engineer's knowledge might often give rise to highly striking and impressive lighting effects.

The concluding illustrations are shown merely as an example of the deceptiveness of photography, when it is deliberately intended to produce a misleading effect. Figs. 7 and 8 show two views of the same house taken respectively in full daylight and in dusk. The photographs have not been retouched in any way. All that has been done is to vary the exposure and development so as to make the pictures look as much alike as possible. It is only on close examination, when one sees the shadow on the roof in the left-hand photograph and observes the artificial lamps shining through the glass above the door on the right, that one can detect which is taken by day and which by night.

These two photographs are reproduced to show the futility of photographs taken with the object of comparing two systems of lighting or two installations, unless reliance can be placed on the impartiality of the experimenter. Photography is a most valuable tool in the hands of the lighting engineer, if wisely used; but, like all tools, it can be misused and applied to give most deceptive results.

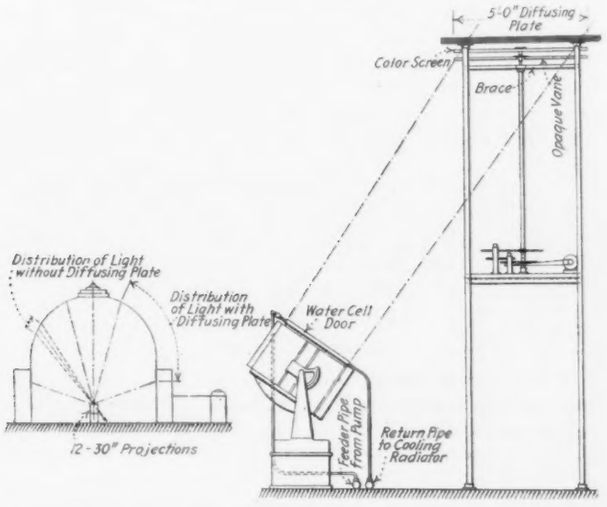
Long-Hour Lighting Methods in Denver

The Denver Gas & Electric Light Company, seeking for means to fill up the valley in the load curve after the evening peak, has recently started a campaign to induce business men to connect the interior lighting of their stores or places of business with outside switches, with the understanding that the electric-service company's patrolman is to turn out the lights at midnight. This allows the merchants to keep their stores brilliantly illuminated as long as there are any people on the street. It is found that merchants using this system take great pains to have the interior of their establishments always in fine shape. This creates a habit that reaches into the daytime, and this neat appearance causes much favorable comment, valuable advertising being the result. Several merchants have already adopted the plan, the largest restaurant in the city being one of the first. When one sees the big array of tables, with their spotless linen, brought out so advantageously under the brilliant lighting, he cannot but be impressed with the fact that here is a good place in which to dine.

The company has also been quite successful in taking flat-rate contracts for second-story and third-story window lighting which burns from dusk until midnight. The merchants using this form of advertising are some of the largest in the city.

The Great Luminous Dome for the Palace of Horticulture

The palace of horticulture at the Panama-Pacific International Exposition to be held at San Francisco next year will be built almost entirely of glass and will be surmounted by a dome 150 ft. high and 152 ft. in



METHOD OF ILLUMINATING DOME FOR PALACE OF HORTICULTURE

diameter of similar construction. To illuminate this dome from the interior and to make it one of the feature spots of the exposition sixteen 30-in. searchlamp projectors will be placed in a circle about a column at the center of the dome. At the top of this column, as shown in the accompanying sketch, will be mounted a color screen of six segments, an opaque vane which will cover two segments at the same time, a lens and a diffusing plate.

The segments of the color screen will be of red, green and yellow. The screen will revolve at the rate of 500 r.p.m. and the vane at the rate of 499 r.p.m., thus enabling the screen to make one full revolution a minute more than the opaque vane.

The rays of the searchlamps will be thus focused on the screen and diffused onto the dome, the revolutions causing the various colors of the spectrum to illuminate the glass.

A combination of three lenses will be used, so arranged that only one will be in position over the screens at one time. One lens will be composed of a number of tiny lenses which will have the effect of producing "spots" of light upon the dome. Another will be plain. The third will produce the most spectacular effect of all, presenting the appearance of countless tiny tadpoles squirming about the interior of the dome.

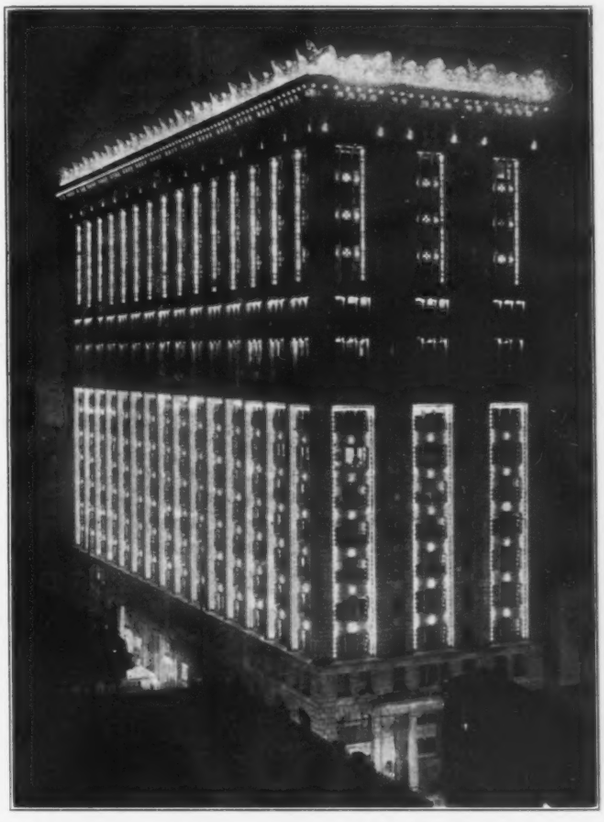
Steel-Taped Cable Installations

At a recent weekly luncheon of the Chicago Jovian League Mr. M. R. Lash, of M. B. Austin & Company, gave a short talk to those present concerning steel-taped cable and its installation. In describing comparative costs for underground distribution systems the speaker said that to install 1000 ft. of three-conductor No. 6 circuit in vitrified-clay conduit would cost $780; the same circuit in fiber conduit, $640; in lead cable, $606, and in steel-taped cable, $400. Quoting from reactance tests on single-conductor steel-taped cable laid in Charles City, Ia., the speaker said that 1000 ft. of No. 6 wire carrying 2300 volts showed a drip of 6.7 volts, of which 3 volts was accounted for by ohmic resistance. These results, he said, prove the feasibility of using such cables on series alternating-current circuits.

Exterior Illumination of New York Companies New Building

A carefully studied example of the exterior illumination of a large building is to be found in the new home of the New York Edison Company and the United Electric Light & Power Company at Irving Place and Fifteenth Street, New York City. The present artistic scheme of decorative lighting was evolved only after months of experimenting and testing, during which, it is reported, the companies' illuminating engineers arranged lamps of various candle-power at different distances, positions and angles, and then made observations from a distance. Four thousand tungsten lamps ranging from 10 watts to 500 watts and aggregating 128,000 cp are used on the outside of the building alone.

The brilliancy of the illumination is accentuated by the gilt trimmings of the building, the coping presenting the appearance of a golden crown of light. This



EXTERIOR ILLUMINATION OF ELECTRIC-SERVICE COMPANIES BUILDING, NEW YORK

coping consists of alternate large and small gilded fans set a short distance apart, the large ones being about 8 ft. high. Lamps for illuminating these fans are arranged at their base similar to stage footlights. As the result this surmounting feature has from a distance the appearance presented by a delicate tracery of gold lace.

Letters to the Editors

Systems of Charges for Energy

To the Editors of the Electrical World:

Sirs:—The advancement of civilization has developed systems of measurements as required by each new service or commodity until at the present time all services may have a number of systems for measuring the quantity bought and sold, as, for instance, electrical energy, which is measured by the kilowatt-hour, horse-power-hour, lamp-hour (size of lamp being designated), etc.

When a new service is first offered to the public it is generally sold in an unmeasured state, since, being new, it requires a development period before it has created and established a market. During this period the supplying company should receive some compensation from the consumer for the service supplied. This compensation depends upon the market created and the social convenience or necessity of the service. It is during this period, too, that the service is frequently sold in an unmeasured state as stated above. This method of selling is often the best, because, the service being new, there is practically no knowledge regarding the actual costs of supplying it. A hypothetical cost would very likely be far from the actual cost at that time or from the actual cost when the business becomes established.

In the majority of cases satisfactory methods and means of measuring the new service are undeveloped and unknown in the earlier periods of the art. If it is employed for a purpose similar to that for which an existing service is used, some of the methods of measuring, as well as some of the systems of charges, of the existing service may be utilized until the art is more fully developed, but this may not be as satisfactory to both the supplying company and consumer as an unmeasured system of charges.

When the service is bought or sold in an unmeasured state the consumer is entitled to use whatever quantities he wishes whenever and in whatever way he wishes. In fact there are no restrictions placed upon his method or manner of using the service. Moreover, the supplying company must supply him with whatever quantity he desires to use and at whatever time he desires to use it, for which it receives in payment a predetermined amount at stated times.

The sum paid per period may be more or it may be less than a reasonable price when all the factors entering into the cost of supplying the service are considered. This depends largely upon the demand made by the consumer for the service, the quantity of the service used and the time when it is used.

The unmeasured system of charges may be satisfactory to both parties as long as the number of consumers is small and the supply unlimited, but as soon as the number of consumers becomes large and the supplying company gives some thought to the cost of supplying them this system of charges proves to be very unsatisfactory to the company as well as unfair to the consumer who makes only a small demand or uses only a small quantity of the service.

The unmeasured system of charges wholly disregards the three elements of cost. It is a system of charges based upon the normally unjustifiable principle which is commonly known as "expediency."

In the electric industry, when the service is not measured by a meter, it has become common practice to refer to the system as a contract rate. In other public utilities the term "contract" is not often applied to a system of charges.

There are several systems of charges that are commonly known as contract rates or systems of rates. As a general rule this name is given to any system in which the quantity of service to be supplied to the consumer is stated in a contract. Great care must always be used not to confuse the name of the system with the method of securing the business. If the service is measured, no matter by what manner or means, the system must necessarily be classed as measured. If there is any statement or clause in the contract that mentions or infers that the demand made upon the supplying company, the quantity of the service to be supplied, or the time when the demand is made or when the quantity is supplied is to be controlled or measured, the service is not purchased under an unmeasured system but under one of the seven measured systems described later.

An illustration of an unmeasured system of charges is the proviso in the franchise or powers granted a water-supplying company by a municipal government stating that all school buildings or all municipal buildings shall be supplied free of charge with water from the supplying company's system.

Measured Service

The development of new services has been so gradual that methods and standards of measurements have been devised and developed about as soon as required by the new businesses. It requires a new business threatened by active competition to develop new methods of measuring the service as well as new systems of charges.

Just as soon as a new service creates a market of sufficient size to be profitable there is a tendency in most cases for numerous persons or companies to engage in the same or like business as competitors. This is not true when the service, or some essential of the commodity or rendering of the service, is controlled by a patent right or exclusive franchise.

The competing company, as an entering wedge, formulates and puts into practical operation a system of charges by which the consumer can be supplied with the service at an apparently lower rate than that charged by the existing company. To be able to retain its present consumers and to obtain additional consumers the existing company must make its charges appear equal to or lower than those of the new company. The unmeasured system of charges is very unsatisfactory when the prices have to be repeatedly changed. Should the existing company be using an unmeasured system of charges it will, for economic reasons, abandon the existing system and establish in its place a new measured system.

A shrewd business management, as soon as it begins to study or even to think about the cost of supplying the consumer with the service, discovers the economic wastes incurred by the unmeasured system of charges and adopts a measured system.

When formulating a new system of charges for a new service, remodeling systems of charges already in use, or judging of the reasonableness of a system of charges in connection with regulation proceedings, it must always be kept in mind that the system is of necessity either a measured or an unmeasured one and that for a measured system the total cost of supplying the service will depend upon three elements of cost. These are:

The demand that the consumer is likely to make upon the supplying company,

The quantity of the commodity or service that the consumer takes or uses, and

The time at which the consumer makes the demand and the quantity then taken or used.

Fundamental Principles

The fundamental principles upon which all systems of charges now used or which have been used are based,

no matter how simple or complex they may appear, may be designated as follows:

Unmeasured { Unrestricted / Restricted { Time / Place

Measured { Demand (maximum rate of consumption) / Quantity (consumption) / Time

The unmeasured system, as a general rule, wholly ignores all three elements of cost and allows "expediency" to be the ruling principle. Expediency may be a satisfactory principle to use as a base for a system of charges while the supplying company is developing a new service, but on account of its perverting nature it it has no justifiable right to be principally used afterward as the base if the system is to be equitable to the consumer as well as to the supplying company.

All the measured systems of charges recognize as a base one or more of the three elements of cost. There are seven apparently fundamental systems of charges which have as a base one or more of the three elements. Of these seven systems, one has all three elements as its base and it is the fundamental system of charges, the other six being only partially fundamental. The degree with which they approach the fundamental system depends upon how closely the elements of costs used as a base approach the total cost of supplying the service. These seven systems may be divided into the three following classes:

Monadic, which involves measurement by only one of the fundamental units, either demand, quantity or time.

Dyadic, which involves measurement by two of the fundamental units.

Triadic, which involves measurement by all three of the fundamental units.

The monadic and dyadic classes have three systems of charges, the partially fundamental, while the triadic class has only one, which is the fundamental system.

Monadic System of Charges

The monadic system of charges is apt to be inequitable to either the supplying company or the consumers or both. A system of this nature may favor consumers having particular individual requirements more than other consumers having very different requirements and, by so doing, it unjustly discriminates against the latter class. The costs of supplying the service are not equitably apportioned among the various consumers having different requirements and habits of use, because, as this system is not a complete measure of the service, there is no way of knowing definitely how much the two ignored elements of cost affect the total cost of supplying the service to the individual consumer. The true cost of supplying the service to the consumer not being known, the amount of profit derived from each consumer is not always the proper percentage of the reasonable value of the property actually used and useful in conducting that part of the business which relates to the particular consumer. There will be some consumers who pay an undue amount of the expenses as well as of the profits of the supplying company, while others may not reimburse the supplying company for their apportioned share of the expenses or profits.

There are services which by the methods or the conditions under which they are manufactured, sold or delivered have the major portion of the total expenses represented by one of the elements of cost and the other two elements have only a slight influence upon the total cost of serving the consumer. Under these circumstances a system which has the most important element as a base and ignores the other two, which are of only minor importance, may be equitable, but the conditions named can never be taken for granted. The greatest injustice is done to the consumers and supplying company (or to the consumers alone if the supplying company is prosperous) when the system has as a base one of the elements of cost which enters only in a minor degree into the cost of supplying the service and ignores a dominant element and also perhaps a minor one.

Even if a system is applicable to one special class of service, that is no reason *a priori* why it will be suitable and fair for other kinds of service, because the differences between the means and methods of producing and distributing the service give different weights and values to the three elements of cost. No one kind of service can be used as a criterion for all others, but analytical studies must be made of any service to which it is proposed to apply a monadic system of charges.

Dyadic System of Charges

The dyadic system of charges has for a long time been considered ideal for public service companies because in most cases it approaches more nearly the total cost of supplying the service. Indeed, this system, having two of the three elements as a base, is usually more equitable than the monadic system of charges. The chances of unjust discrimination between consumers are not nearly so great because the expense of supplying them is more equitably distributed, and in general no one consumer is required to pay exorbitantly high prices to help defray the expenses caused by another consumer favored with an unduly low charge. With some kinds of service the total expense of supplying the consumers is substantially represented by two of the elements of cost, the third being nearly negligible. If the two elements which really dominate the cost of the service are those which are allowed to enter into the formulation of the system, it approaches in justice the triadic system. However, it must be taken into consideration that there are cases where the location of the business may make one element of cost of greater importance than the other two, while in a different location the reverse would be true.

Moreover, as a system of charges approaches more nearly the true or actual cost data for supplying the service, neglecting one of the three elements of cost, no matter how unimportant it may be, has necessarily greater influence in determining whether the system is an equitable distribution of costs. While with some classes of service it approaches the true cost of supplying the consumer, the dyadic system of charges may be as faulty in this respect as the monadic system, and the triadic system is then the one recourse.

Triadic System of Charges

In the triadic system of charges all three of the elements of cost enter as a base. No element is wanting. All are considered, and each receives the proper position due its importance. The chances of favoring any one consumer are reduced to a minimum through the triadic system. Likewise discrimination is reduced to a minimum. Each consumer pays his proper proportion of the expenses and of the profits. The size of the consumer has no undue influence on the privileges accorded him. The small consumer is assured the treatment due him by right the same as the large consumer.

This is in reality the only complete system of charges, because it considers every element of cost. A system of charges to be reasonable to both the supplying company and the consumer, which should always be the aim, must consider all the factors that enter into the total cost of supplying the consumer with the service. The triadic system of charges is the only one that fulfils all of these requirements.

Atlantic, Mass. L. C. TOMLINSON.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Water Rheostat Mechanism for Operating Induction Motor

To start and stop large wound-rotor motors frequently with a hand-operated controller is usually tedious work, and the cost of installing an automatic controller to perform this operation is sometimes pro-

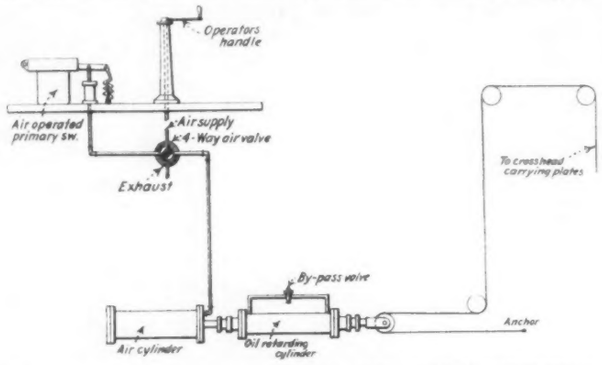


FIG. 1—OPERATING MECHANISM FOR WATER RHEOSTAT

hibitive. The apparatus illustrated herewith, which is used to control a 450-hp motor at the Penn Iron Mines, Vulcan, Mich., is simple and requires only a moderate investment. A single air valve simultaneously controls an air-operated primary switch and regulates the resistance in the rotor circuit by raising or lowering plates in a specially designed water rheostat.

This water rheostat consists of an open-top concrete tank containing a weak solution of sodium carbonate

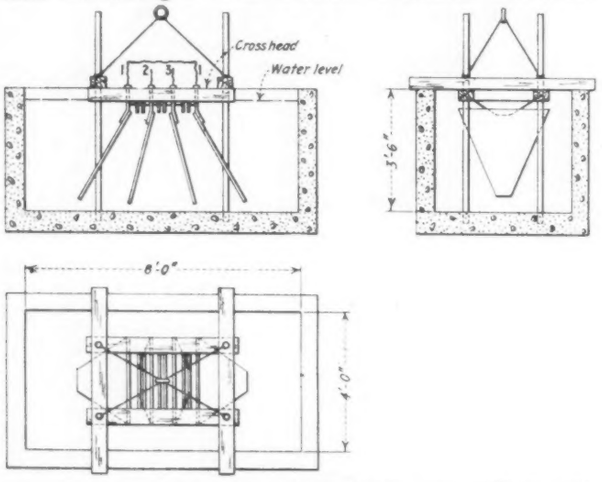


FIG. 2—WATER-RHEOSTAT CONTROLLER FOR 500-HP INDUCTION MOTOR

in which three sets of plates electrically connected to the rotor rings may be immersed. Four large trapezoidal-shaped plates and six smaller auxiliary plates are suspended from a wooden frame as indicated in the diagram. In raising and lowering the plates the frame supporting them is guided by four vertical rods. The plates are supported at an angle and the narrower sides are hung downward so that when the plates are immersed the conducting areas increase and gradually approach each other.

Between the large adjacent plates and connected to them as shown are the auxiliary plates which enter the electrolyte just as the main plates become completely submerged. By adjusting the distance between the smaller plates the full-load speed of the motor can be fixed.

The plates are raised by a cable operated by an air cylinder and are lowered by their own weight at a speed determined by the valve opening in the by-pass of the oil-retarding cylinder. A four-way air valve is employed to control the primary switch and water rheostat. In one position the valve allows air to enter a small cylinder and close the primary switch, while air

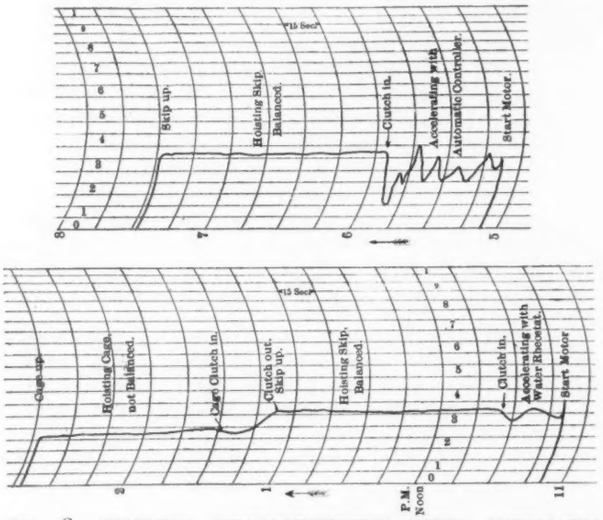


FIG. 3—STARTING CHARACTERISTICS WITH AUTOMATIC CONTROLLER AND WITH WATER RHEOSTAT

is being exhausted from the water-rheostat cylinder, lowering the plates. In the "off" position air the process is reversed.

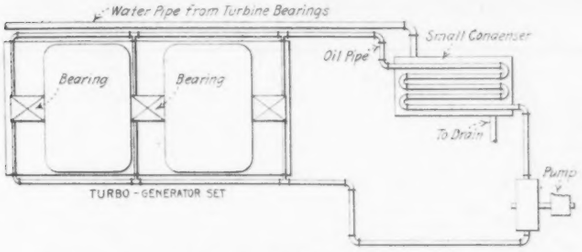
In the accompanying diagrams are shown starting curves employing the water rheostat and also an automatic starting controller with the same motor. With the former the motor was accelerated in twenty seconds, while with the latter forty seconds was required and the energy consumption was less uniform.

Additional Cooling for Turbine Bearing Oil

After two years' operation the bearings on a turbogenerator in the plant of the Canton (Ohio) Electric Company began to heat the oil circulating through them to a degree which Mr. A. L. Platt, chief engineer, considered dangerous, and the scheme shown in the accompanying illustration was resorted to as a remedy. Under the worst of the conditions described oil left the machine at temperatures as high as 189 deg. Fahr., and

in no case was the oil ever cooler than 148 deg. Fahr.

The scheme laid out to reduce the temperature was as follows. A small heater (or, more properly, a small condenser), which had formerly been used on a hot-water-heating system, was inserted in the oil piping. Water piping was also connected so that water leaving the bearings of the machine circulates about these bearing-oil pipes. The oil is then returned to the turbine bearings through a small pump situated in the basement beneath the machine. Since this apparatus has been put into operation water enters the bearings at 54 deg. Fahr. and leaves the machine at 65 deg. Fahr. It is then led through the exterior passages of the small condenser and is delivered to the waste-water system of the station at 80 deg. Fahr., having been raised 15 deg. in passing through the condenser. The result is that oil leaving the last bearing of the machine now registers approximately 132 deg. Fahr. at all times. The cooling water for the turbine is always of even temperature, about 54 deg. Fahr., as it is taken from wells driven on the company's property at one end of the generating station.



PIPING SCHEME FOR REDUCING OIL TEMPERATURE

A Paint That Warns of Overheated Bearings

BY J. P. SCHROETER

Many kinds of paint are at present employed for the purposes of protection and conservation, but no pigment has heretofore been devised with the particular idea of protecting parts of machinery from overheating. Such a paint was, however, recently put on the European market under the trade name "Efkalin," its manufacturer being Franz Korn, of Halle, Germany. This paint, which is of a light red color, is applied as other paints to parts of machines, bearings, etc., which are subject to becoming overheated. The color of the paint immediately changes on exposure to about 50 deg. C. to a brown red, at about 70 deg. C. to a dark red, and at about 85 deg. C. to nearly black. Its bright-red color when cool is so striking that any change is immediately noticeable, giving warning in ample time to avert injury to the machine. The engineer, foreman or superintendent is thus able to see at a glance that everything under his care is in good order without being compelled to feel with the hand or to inspect the bearings closely. Perhaps the most interesting property of this paint is the fact that it changes back again to its original color after the part to which it is applied has been cooled. On this account Efkalin will last practically indefinitely, which is important as the paint is rather expensive on account of its constituents.

Another even more interesting paint is "Acalorin," which is made by Koch & Gruen, Offenbach a. M., Germany. This paint is intended to protect against the heat rays of the sun on hot summer days. Applied to glass or to slate, corrugated-iron or other metal roofs, it is declared to keep the rooms thus covered at temperatures 15 deg. to 35 deg. Fahr. cooler than they would be otherwise, according to the surface covered by it.

Relative Economies of Mercury-Arc Rectifiers and Motor Generators on Arc-Lamp Circuits

In your issue of Feb. 28 "F. L. W." inquires: "What is the ratio of the energy consumptions in the two cases which follow: A 25-amp motion-picture arc lamp operating on a 110-volt direct-current system, and the same lamp fed from a mercury-arc lamp rectifier operating on a sixty-cycle circuit?" Your answer to his question is correct, but his question was improperly stated and therefore he did not get the information desired. He should have stated that about 50 volts is required for the operation of the arc lamp. In the case of the 110-volt direct-current system 50 volts must necessarily be absorbed in the rheostat, incurring a loss of about 54 per cent of the energy purchased. But in the case of the mercury-arc rectifier, operating at an efficiency of 86 per cent, the loss is only 14 per cent. This shows the advantage in the mercury-arc rectifier of 40 per cent over the direct-current service. This solution does not take into account the economy possible by the use of a motor-generator set in place of resistance, but even in this case the comparison is in favor of the mercury-arc rectifier, for it is doubtful if the motor-generator set of 2-kw or 3-kw rating could be built with this efficiency. D. J. E.

The answer printed on page 496 of the *Electrical World* for Feb. 28, 1914, was based on the assumption that in each case the lamp and a resistor would be connected permanently in series to be operated at 110 volts, thus consuming 2750 watts at 25 amp. Since the lamp circuit proper need consume only 50 volts, or 1250 watts at 25 amp, it will be apparent that the series resistor can be eliminated with an initial saving of 60 volts $\times$ 25 amp, or 1500 watts, against which must be placed such losses as occur in voltage or current-transforming apparatus, for example a motor-generator set for the direct-current supply or a mercury-arc rectifier for alternating current. The efficiency of a motor-generator set might be from, say, 55 to 65 per cent, while that of the rectifier might be, say, from 68 to 72 per cent. An outline of the methods in use for supplying energy for motion-picture arc lamps was printed on page 513 of our issue dated Sept. 7, 1912.

Magnetization Values of Silicon Steel

Will you furnish me with some values of the flux density which can be obtained in 2.75 per cent silicon steel with the corresponding values of field intensity? A. U. A.

Values of flux density obtainable in silicon steel with a definite field intensity vary slightly because of different methods of conducting the experiments, but these differences are quite small. In the *Electrical World* of Aug. 31, 1907, it was stated that the reluctivity of a certain sample of 3 per cent silicon steel was about 60 micro-ersteds per unit of mmf, which would give a flux density of about 16,660 with a field intensity of 200. But this value is only approximate, being computed from an average reluctivity and unit mmf. In a later issue of the *Electrical World* there were published more extensive data on magnetization-curve values, also taken from 3 per cent silicon steel. The data referred to are as follows:

Ampere-turns per inch.....	25	50	100	200	300	400	700
Kilolines per square inch.....	85	95	105	110	115	120	130

Another article appearing in the Sept. 20, 1909, issue of the *Electrical World* said that the flux density in 2.28-3.15 per cent silicon steel is 17,000 when the field intensity is 140. More recent data on 2.5-3.5 per cent silicon steel are given below. These are average values taken from twenty-nine tests made on rings of 0.014-in. sheet silicon steel.

B	*H*	*B*	*H*
18,600	200	14,640	20
17,000	100	14,260	15
15,860	50	13,660	10
15,180	30		

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Brushes for Traction Motors.—G. BASIL BARHAM.—Some general notes on brushes for traction motors. The properties of coke brushes, coke-graphite brushes and graphite brushes, a hardness test and an electric test for brushes are described. Current passing through the holder springs draws their temper, makes them weak and leaves the brushes with insufficient tension. If sparking of a brush is due to weak tension, the sparking will cease when the brush is pressed down with a stick—which is the test for poor tension. Many times, however, excessive tension is used as a cure for sparking due to some other cause. All tension over and above what is needed merely increases the wear on the commutator and brushes, and is to be avoided. Sparking troubles sometimes attributed to poor adjustment of the holder may be due to a rough commutator or eccentric commutator, or to a high or low or loose bar in the commutator, or to a loose core, or to the commutator having twisted around until the bars short-circuited by the brushes are no longer connected to coils that are in a commutating part of the field. It is therefore advisable to see that all parts are in perfect order before interfering with either brushes or brush holders.—London *Elec. Times*, Feb. 12, 1914.

Lamps and Lighting

"Half-Watt" Lamps.—Brief illustrated descriptions of a number of special types of "half-watt" lamps of English make. Special features are the arrangement of the filaments so as to send the light in a certain direction, the use of special reflectors, and special forms of the globes.—London *Elec. Times*, Feb. 5 and March 5, 1914.

Electric Lighting of Steam Passenger Trains.—C. W. BENDER.—An article, illustrated by diagrams, discussing the different systems of electric lighting of passenger trains on trunk-line railroads. These systems may be classified under three main headings, namely, straight storage, head-end and axle-generator. Each of these systems possesses advantages and also disadvantages over the other two systems, and these are analyzed by the author. As adapted by different railroads, each system shows modifications that have been made to fulfil the needs of its special service, and each modified system is described and illustrated.—*Gen. Elec. Review*, April, 1914.

Generation, Transmission and Distribution

German Energy Supply Statistics.—G. SIEGEL.—A statistical article on electric energy supply with special reference to Germany. The generating rating of power plants in Germany in millions of kilowatts was 0.06 in 1891, 1.60 in 1900, 6.10 in 1909, 8.01 in 1911 and 10.10 in 1913. In the mining district of Dortmund the electrical connected load was 24,499 kw in 1906, 100,144 kw in 1908, 188,474 kw in 1910, and 280,276 kw in 1912. The total connected load of the municipal central stations of Germany in thousands of kilowatts was 36 in 1895, 655 in 1905, 1873 in 1909, 2478 in 1911, and 3726 in 1913. In Austria there were in 1911 740 stations with 378,736 kw of rating and 461,755 kw of connected load, while in 1913 there were 854 stations with 457,010 kw generating capacity and 568,595 kw in connected load. In Switzerland there were 766 stations with 360,000 kw capacity in 1911, and 1000 stations with 434,000 kw in 1913. In France there were 700 stations with 130,000 kw in 1901, and 1860 stations with 900,000 kw in 1911. In England there were 311 stations with 851,000 kw of rating and 1,181,000 kw connected load in 1909, while in 1911 there were 393 stations with 962,000 kw of rating and 1,395,000 kw in connected load. In the United States there were 4712 stations with 4,032,000 kw of rating in 1907, and 6128 stations with 9,476,000 kw in 1912. In Germany 9,000,000 persons were employed in industrial plants in 1900 and 12,400,000 in 1913. The kilowatt-hours used per workingman have increased from 111 in 1900 to 850 in 1913. The annual coal consumption per industrial workingman has increased in the same time from 6.55 tons to 8.20 tons. In the period from 1900 to 1913 the sale of electrical energy per industrial workingman has therefore increased by 770 per cent, while the coal consumption has increased by 25 per cent. An extensive table is also given on the comparative consumption of electricity and gas; it shows a rapid increase of the use of electricity.—*Elek. Kraftbet. u. Bahnen*, March 4, 1914.

Horn-Type Lightning Arresters.—C. GARRARD.—An illustrated article in which the author gives curves showing the jumping voltage of horn-gap arresters to be dependent on the gap and the diameter of the rod used for the horns. He then considers what value should be taken for the series resistance used with such arresters to limit the short-circuit load to a convenient figure. In practice the best results are obtained by experiment; that is, by trying different values of series resistance and using the lowest that is possible with regard to safety of operation. As liquid resistors lend themselves most easily to adjustment and moreover possess other characteristics fitting them for this work, they are generally to be recommended. The surface should be covered with a layer of oil to prevent evaporation. To know approximately the values which such resistors should have, some considerations are given based on a theory by Steinmetz.—London *Electrician*, March 20, 1914.

Small Outdoor Substation.—E. B. MERRIAM.—The central stations of the country, in co-operation with the manufacturers of electrical apparatus, have from time to time conducted campaigns for the education of the farmer and the rural resident in the conveniences of electricity; but before any returns can be realized from these efforts it becomes necessary to supply the prospective customers with a source of electric power and at a cost for equipment that will insure a fair return upon the investment. This has been a problem for the manufacturer, and in the present article the author describes some of the apparatus that has been developed for tapping off small amounts of power from medium and high-voltage transmission lines. Such substations are usually installed out of doors to save the cost of a special building, and the designer is confronted with the problem of producing an inexpensive

piece of apparatus which at the same time will insure reliable service under severe conditions.—*Gen. Elec. Review*, April, 1914.

Recent Tests in Railway Power Stations.—An illustrated article on recent boiler tests in the Formby power station, which supplies energy to the electrified section of the Lancashire & Yorkshire Railway between Liverpool and Southport. The test of the Lancashire boilers lasted eight hours. Draft downtake, 0.31 in. water gage; CO_2 in flue gases at downtake, 15.5 per cent; temperature of feed-water entering economizer, 52.8 deg. Fahr., and entering the boiler, 196.4 deg. Fahr.; steam pressure, 155.75 lb. per sq. in.; superheat, 135.17 deg. Fahr.; ordinary firing slack used, containing 13,208.9 lb. Fahr. heat units per pound of dry coal; total coal burned, 88,244 lb.; evaporation per pound of dry coal, 10,717 lb.; total thermal efficiency, 81 per cent.—London *Elec. Times*, March 12, 1914.

Rolling Mills.—WINTERMEYER.—An article, illustrated by diagrams, on different systems of electric operation of rolling mills.—*Elek. Kraftbet. u. Bahnen*, Feb. 24, 1914.

Traction

St. Gothard Railway.—JOHN B. SPARKS.—An article giving particulars and estimated cost of equipment of 67 miles of route, using the fifteen-cycle, single-phase system at 7500 volts. This line will be completed in 1918. Steam and electric traction are compared by the author. The estimated saving per train mile of electric operation is 3.42 cents. The total annual saving is $52,500. While the cost per electric locomotive-mile is considerably greater than the cost per steam locomotive-mile, the saving in operation is effected by the use of fewer but more powerful locomotives. The cost of electric energy is over 50 per cent of the total cost of operation. While the actual generating costs are not given, it would appear that the electric energy will cost at least 1 cent per kw-hr. delivered to the collector of the locomotive.—London *Elec. Times*, March 19, 1914.

Railway Motor Gearing.—W. G. CAREY.—The author traces the development of railway motor gearing from the time that gears and pinions (as used on stationary apparatus where plenty of space is available to permit the use of cast iron) were applied to railway motors down to the modern gearing which has been developed to meet the severe conditions of up-to-date railway practice. Most of the early part of this work resolved itself into devising means and ways of increasing the life of the pinion to approximate that of the gear. The different methods adopted to produce a harder and more durable pinion are described. The life factors necessary to determine the maintenance cost of different types of pinions are given.—*Gen. Elec. Review*, April, 1914.

Mining Locomotives.—F. RIEP.—An article giving data of first cost and cost of operation for mining locomotives energized from a trolley wire.—*Elek. Kraftbet. u. Bahnen*, Jan. 24, 1914.

Electric Braking.—C. ROSSINSKY.—A fully illustrated description of an automatic brake system employed on trailers of a German railway having considerable grades. The magnetic track brake is used and the brake is automatically set in operation should the trailer be accidentally separated from the motor-car.—*Elek. Kraftbet. u. Bahnen*, Jan. 4, 1914.

Installations, Systems and Appliances

Italy.—A review of the status of the electrical industry in Italy in 1912. Of the large electrical companies of Italy only two did not pay any dividend in 1912. Fourteen paid the same dividend as the year before, nine paid a higher dividend, and three a smaller dividend. The average dividend was 6.69 per cent, against 6.56 per cent the year before. With respect to the amount of invested capital the electricity supply industry is now the most prominent Italian industry, but considerable money from outside of Italy, especially from Switzerland and Belgium, is invested in Italian electric plants. The total capital thus employed is $98,000,000, with a reserve fund of $10,000,000 (or 10.4 per cent of the capital). Considerable progress is being made in the development of water-powers. During 1910 and 1911 125 licenses were granted for developing water-powers of an aggregate of 80,000 hp, increasing the total water-power so far developed for the generation of electricity to 956,000 hp. Of this, 678,000 hp is in northern Italy, 215,000 hp is in central Italy, and 61,000 hp is in southern Italy and on the islands. Considerable power is being used for traction.—*Elek. Kraftbet. u. Bahnen*, Feb. 4, 1914.

Cooking and Heating.—Illustrated notes on progress in cooking and heating in Great Britain. The use of electricity at the National Training School of Cooking is described. Further, various pieces of cooking apparatus are described, together with an open-scale low-reading wattmeter for use in rooms to take readings of the energy consumption of cooking and heating apparatus. Roberts, the borough electrical engineer at Durban, Natal, reports the great success of a new rate schedule in which the minimum charge is based upon the ratable value of the property supplied, and covers a certain number of "kelvins," while all energy in excess of this minimum is charged for at 1.5 cents per kelvin. For tenants of premises rated at $6,000 the minimum charge is $3.62 per month, and increasing minimum charges are made according to the value of the property up to $24,000, for which the minimum required is $6.25 per month. The number of consumers who have taken advantage of the new tariff is 550, and although it cannot be claimed that all these are using electricity largely for cooking purposes, many are doing so and the amount of energy supplied at 1.5 cents is increasing steadily. During August, 1912, for instance, 22,147 kw-hr. were sold at this rate, but in July, 1913, the number had grown to 51,676 kw-hr. Complaints are few. The mean consumption for an average family is 15.20 kw-hr. per day, while for a household of two the daily consumption averages 10 kw.—London *Elec. Times*, Feb. 5, 1914. Other electric cooking and heating notes in London *Elec. Times*, Feb. 12, 1914.

Combined Municipal and Private Ownership.—An editorial note stating that the "mixed system" of combined private and municipal ownership does not seem to be an unmixed success in Germany. At Cassel the town authorities have finally refused to deal with any of the great electrical groups in Germany, so the fifteen-hundred-thousand-dollar scheme of the Allgemeine Elektricitäts Gesellschaft has been abandoned. The municipality intends to execute the work itself. A correspondent writes: "This seems to be the forerunner of the reactionary feeling that is setting in, and I am inclined to think that as far as large stations in Germany are concerned we shall see very little more of this mixed-company business." The Bavarian Ministry has just decided to take complete control of its 90,000-hp water scheme without the participation of private enterprise.—London *Elec. Times*, Feb. 26, 1914.

German Electrical Industries.—A continuation of the series of reviews on the status of the different electrical industries in Germany in 1913. Alfred Schwartz deals with measuring instruments, meters and methods of measurement, Markus Dumermuth with overhead and underground line construction and cable manufacture, A. Steinhaus with electric lighting, A. Steinhardt with electric heating and cooking, and G. W.

Meyer with electric driving of machines.—*Elek. Zeit.*, March 19, 1914.

Electricity in Bavaria.—F. Gebele.—A general review of a Bavarian government publication on electricity supply in Bavaria at the end of 1913. Data as to the ownership and equipment of the different power plants are given with a map, and figures are presented on the first cost and rate schedules of different stations.—*Elek. Zeit.*, March 19, 1914.

Wires, Wiring and Conduits

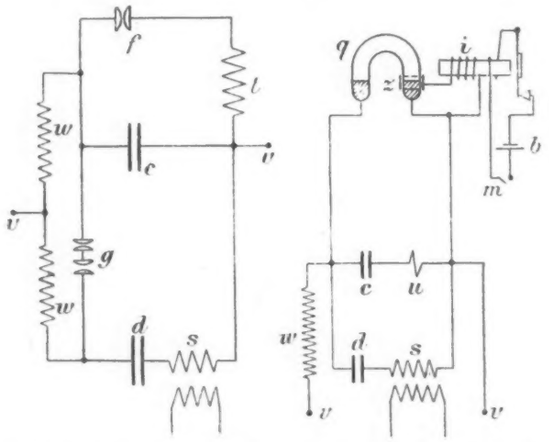
Feeder Reactance.—F. C. Barton.—The author gives reasons why feeder reactances should be included in many station equipments to assure furnishing uninterrupted and high-quality service. Their disadvantages are also discussed and are shown to be of a far less serious nature than has often been supposed. —*Gen. Elec. Review*, April, 1914.

Electrophysics and Magnetism

Physical Science.—J. J. Thomson.—A review of his first three lectures before the British Royal Institution on recent discoveries in physical science dealing especially with problems of atomic, molecular and electronic theory.—London *Electrician*, March 20, 1914.

Units, Measurements and Instruments

Charging Two Condensers in Parallel and Discharging in Series.—In an article by W. H. Eccles on recent progress in wireless telegraphy mention is made of a patent of the Compagnie Générale Radiotélégraphique for a new method of charging two batteries or condensers in parallel and discharging them in series. The advantage accruing from this process has led to many former proposals of means for effecting it, most of them depending on the arrangement and rearrangement of the condenser connections by means of switches. Also it has been proposed to discharge the condensers of two circuits of different periods across the same gap in such a way that when the phases of the currents become opposite the circuits discharge in series. But in the present invention the one condenser remains fully charged until the other has reversed its polarity by discharge, and thus the condensers are connected in series with practically their full charge. Fig. 1 shows a method of carrying out this result. The two condensers *cd*, approximately equal, are charged from the



FIGS. 1 AND 2—CIRCUITS FOR CHARGING CONDENSERS IN PARALLEL AND DISCHARGING THEM IN SERIES

direct-current or alternating-current mains *vv* through resistance *w*. Spark gaps *fg* and inductance coils *st* are arranged as shown, *s* being coupled with the antenna and the inductance of *t* being greater than that of *s*. Imagine that the voltage rises till the gap *f* breaks down. Condenser *c* discharges and *d* cannot, but when *c* has by discharge reversed its voltage there exists practically double voltage in circuit *csdg* and the gap *g* breaks down. It is stated that a more practical form of the apparatus is obtained by replacing the spark-gap *f* by a mercury lamp, thus taking advantage of the remarkable quenching powers of the mercury-vapor arc. In this case the action is a little different and is worth notice. In Fig. 2 the coil *u* in series with condenser *c* is very small compared with coil *s* in series with condenser *d*, and therefore *c* discharges more quickly than *d*. The mercury lamp *q* is provided with a starting terminal *z*, energized by the inductorium *i*. Initially condensers *cd* are charged, and when the inductorium lights the lamp *c* begins its discharge and performs half a swing in a time so short that *d* loses little charge. At the moment *c* becomes fully charged with electricity of reverse sign, the current through the lamp vanishes, the lamp is extinguished, and both condensers now discharge in series in the circuit *cusd*. The lighting of the lamp may be accomplished by a rotating commutator, so that a musical note is produced by signaling.—London *Electrician*, March 20, 1914.

Electric Thermometer.—Hans Vogt.—An illustrated article on the measurement of temperatures at a distance by electrical means. The arrangement of the Wheatstone bridge is described. For measuring temperature at three different places the arrangement of Fig. 3 may be used. S_I, S_{II}, S_{III} are the three resistance wires of nickel or nickelin, having a temperature coefficient of 0.0042 or 0.0043. By closing one or the other of the three contacts D_1, D_2 and D_3 any one of the three resistors S can be connected to the Wheatstone bridge so as to measure the temperature at that particular place. The wires *b*, *c* and *d* are made of constantan, which has a very low temperature coefficient. *B* is a battery and *J* a galvanometer of high sensitiveness. By means of the contact D_4 the resistance *Rw* can be inserted into the Wheatstone bridge for control and regulation. Since the voltage of the battery *B* changes somewhat correction must be made for this change. For this purpose the resistance *Rw* is inserted in the Wheatstone bridge and the needle of the instrument adjusted to a zero point. W_1, W_2, W_3 are small resistance coils which make the readings independent of the leads to the three resistance coils *S*.—*Zeit. f. Feinmechanik*, March 20, 1914.

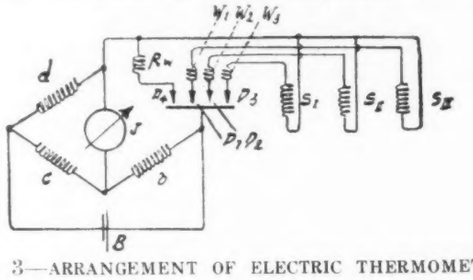


FIG. 3—ARRANGEMENT OF ELECTRIC THERMOMETER

Telegraphy, Telephony and Signals

Wireless Telegraphy.—W. H. Eccles.—A second article of his review on recent patents in wireless telegraphy and telephony. The chapter on generating equipment is concluded and the author passes on to receiving apparatus.—London *Electrician*, March 20, 1914.

Wireless Telegraphy.—Eugen Nesper.—An article, illustrated by diagrams, on the so-called "shock excitation," describing besides Wien's shock excitation another so-called ideal shock excitation. The article is to be concluded.—*Elek. Zeit.*, March 9, 1914.

Book Reviews

MOLDED ELECTRICAL INSULATION AND PLASTICS. By Emile Hemming. New York: Ward, Clausen & Company. 207 pages, illus. Price, $3.

This treatise is devoted exclusively to molded insulating materials and such plastics as are in common use in the electrical industry. An authoritative textbook and reference on this subject has long been conspicuous by its absence, and the present work will doubtless be welcomed by electrical engineers, designers and manufacturers alike. Unlike many works dealing with manufactured products, the book contains only first-hand information, indicating the author's intimate knowledge of the subject and his practical experience as well. Historical references are limited to the past ten years, which may be said to embrace the renaissance period in the art of molded insulation. Previous to that time very little had been done except with non-heat-resisting molded materials and porcelain, and designers were content to use the simple products they found at hand. The latter are described, together with other discarded materials which have been brought out from time to time only to fail in actual service. The various classes or types of molded insulation which have survived and are now in general use are fully described. A feature of interest is the space devoted to the raw materials employed in their manufacture. No reference is made to individual products, the author establishing a general classification based on characteristic principles of manufacture. The various classes and their properties are very fully discussed in the light of their behavior under actual service conditions. Not the least valuable part of the book, especially to the engineer and the designer, is the very practical chapter devoted to illustrations of typical insulating parts with brief but satisfactory notes indicating the class of material best suited to particular conditions. It is not unusual for designers to consider only the mechanical and electrical features of apparatus and to ignore the limiting conditions of insulation manufacture. This often results in a narrow choice of material or in high cost owing to complication of design, both of which might be avoided by a better understanding of molding requirements. The chapter on die or mold design will therefore be welcome, detailing, as it does, the essential points to be considered in the design of parts. Tables compiled from electrical tests made especially for this work are included. The concise yet thorough treatment of the subject by the author and the practical nature of its contents make the book a valuable addition to the library of the electrical engineer.

DAS MODERNE BELEUCHTUNGSWESEN. By Dr. H. Lux. Leipzig, Germany: B. G. Teubner. 1914. 120 pages, 54 illus. Price, 1.25 marks.

This recently issued little volume—No. 433—of the well-known Teubner series gives a good description of the theoretical and practical relations of artificial illumination. The book is divided into two sections, the first theoretical and the second practical. The chapters in these sections relate to the following topics: The nature of light; temperature emission; luminescence; photometry; artificial illumination; fuel-burning lamps; gas lighting; electric lighting; comparison of various light sources. The treatment of the subject is essentially practical and from the applied science standpoint. The book is strongest on the side of its radiation theory. It will be of interest to students of illuminating engineering desirous of acquainting themselves with German methods, symbols and apparatus.

ANNUAIRE POUR L'AN 1914. Published by the Bureau des Longitudes. Paris, France: Gauthier-Villars. 501 pages. Price, 1f. 50c.

The present is the 118th issue of this annual publication, which is very serviceable to physicists, mathematicians and geodesists as well as to astronomers. The physical and chemical tables have been revised so as to include the latest determinations of important constants. There are three magnetic charts of France, containing respectively the isogonic, isoclinic and isodynamic lines of equal horizontal intensity for the epoch 1911. The supplement contains three papers on subjects of timely interest. The first, by Mr. P. Hatt, is on the deformation of images in telescopes; the second, by Mr. G. Bigourdan, is on the day, its subdivisions, the international meridian and hour-zones, and the last, by Mr. B. Baillaud, is a report on the work of the International Geodetic Association.

L'ANNÉE ELECTRIQUE, ELECTROTHERAPIQUE ET RADIOGRAPHIQUE. By Dr. Foveau de Courmelles. Paris, France: Librairie Polytechnique. 340 pages.

This is the fourteenth of a series of annual volumes successively reviewing the progress of electrotherapy and radiography for the preceding year. The book is primarily intended for members of the medical profession, but incidentally it treats of electrical progress in other lines than those of medical applications. This volume deals with the following subjects in successive chapters: General apparatus, electrochemistry, light, heat, traction, signaling, radio-telegraphy, atmospheric electricity, electricity from various sources, various electrical applications, hygiene, physiology, radiography, radiotheraphy, phototheraphy, radioactivity, jurisprudence, and necrology. The medical side of the subject is fully developed, and much information is offered that will be useful to physicians. The chapters on X-rays are particularly good.

ANNUAIRE DE L'ELECTRICITÉ. Paris, France: *La Lumière Electrique*. 446 pages. Price, 4 francs.

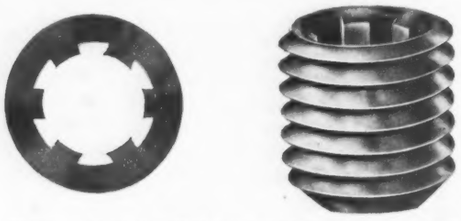
Considerable valuable information relating to the electrical industry in France is published in condensed form in this book, which is divided into eight chapters: Distribution, traction, electrical companies, associations and bureaus, legislation, educational institutions, publications, and electrical manufacturers. In the first chapter, comprising 243 pages, are tabulated the names and population of all communities receiving electrical service grouped according to the departments in which they are situated. The names of the operating companies, station ratings, voltage and nature of energy produced and rates for lamp and motor service are included. Under traction are the names and main offices of companies operating street and interurban railways, together with the routes covered, length of track and method of delivering energy to the cars. The next chapter contains the organization of electrical constructing, distributing, consulting and traction companies, with the date of incorporation, capitalization and location of the main offices. The fourth chapter contains the names, members and officers of various electrical commissions, syndicates and associations. Under legislation are quoted French decrees and decisions promulgated during the last year relating to the electrical industry. Names of electrical educational institutions with their courses of instruction and teaching staffs are listed in the next section. In the seventh chapter are given the names of electrical publications, their editors, frequency of publication and prices of subscription. The last chapter contains a list of manufacturers of electrical apparatus.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Safety Set Screws

One of the results of the "safety-first" movement is a set screw without a head. A device of this kind will eliminate a number of dangerous projections on moving machinery. In Fig. 1 is shown a cross-section of a hollow safety set screw having six dovetailed slots

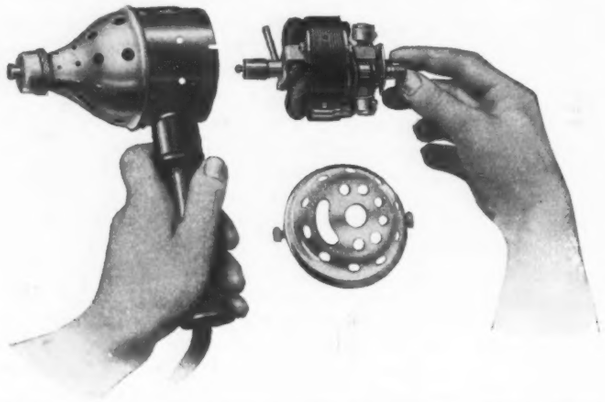


FIGS. 1 AND 2—HOLLOW SAFETY SET SCREW

on the inside. Special "goose-neck" wrenches are provided with six outside flutes to correspond with the six slots of the screw. The wrench fits snugly inside the screw, and in tightening and driving the screw home a uniform rotary motion is given to it. These set screws are subjected to a special hardening treatment, and they are manufactured by the Bristol Company, Waterbury, Conn.

Electric Vibrator

The motor used in the electric vibrator shown in the accompanying illustration can be removed as a unit, and its parts therefore can be easily inspected or repaired. To get at the commutator, the brushes and the starting and regulating device, all that is necessary

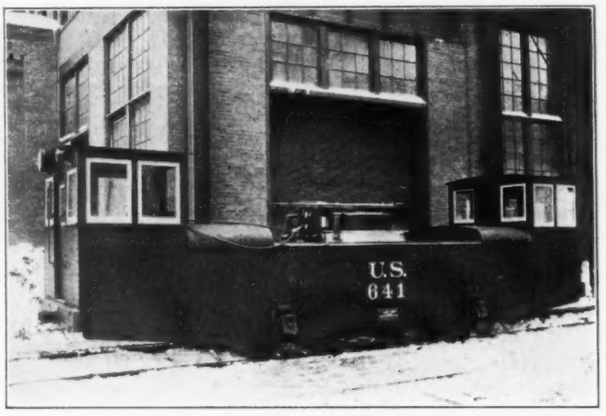


ELECTRIC VIBRATOR WITH MOTOR REMOVED FROM CASE

is to remove the top shell by loosening two thumb screws. The line terminals of the motor consist of two springs, which engage with two pins protruding into the case of the vibrator. When removing or replacing the motor these pins and springs automatically break or make the circuit. The shell of this machine is made of light metal stampings. A spring sleeve which engages the eccentric is designed to take up the wear automatically. This electric vibrator is being placed on the market by the Lindstrom-Smith Company, 1100 Wabash Avenue, Chicago, Ill.

Electric Towing Locomotives for Panama Canal Locks

One of the forty electric locomotives for towing vessels through the locks of the Panama Canal is shown in the accompanying illustration. The machine weighs 82,500 lb. and measures 32 ft. 2.5 in. long by 8 ft. wide by 9 ft. 3 in. high. The locomotive is designed to exert a maximum tractive effort of 47,500 lb. and a windlass-rope pull of 25,000 lb. Four units, two on each side, will ordinarily pull steamships through the locks, although six engines will be needed occasionally to handle very large vessels. No vessel will be allowed to enter the locks under its own power.



ELECTRIC TOWING LOCOMOTIVE

While towing and while going up or down the steep grades from one level to another the locomotive will be propelled by means of a rack rail at a speed of 2 miles per hour. While running idle or on the return tracks, the rack pinion will be released and the speed will be increased to 5 m.p.h. Each locomotive is driven by two 75-hp totally inclosed motors of the mill type, one being directly connected through reduction gearing to each axle. Three-phase, twenty-five-cycle, 220-volt alternating current is used. The motor and traction gearing are mounted on a common baseplate, which in turn is carried on a driving axle and a spring suspended from the locomotive frame.

In the center of the locomotive is a vertical windlass with a drum having a capacity of 800 ft. of 1-in. steel hawser cable. The windlass with its driving motors and gearing is mounted on a solid baseplate. The cable drum extends above the locomotive cover and has a floating guard placed around it to retain the cable while coiling loose.

The windlass is operated by two 20-hp motors which are totally inclosed and of the mill type. One is geared

for a rope speed of 12 ft. per minute at a maximum pull of 25,000 lb. with a 2-ft. radius. The other motor is geared for a rope speed of 200 ft. per minute with a 2-ft. radius. The cable drum is driven through a friction device which can be set for any desired value from zero up to the full capacity of the motor. These locomotives were built by the General Electric Company, New York.

Electric Vehicles for Street Sprinkling, Washing and Sweeping

Electrically propelled street cleaners and sweepers, which have been developed to a high state of perfection by practical operation in several large cities in Europe, are at the present time being introduced into Great Britain by Messrs. Mossay & Company, Ltd., of Westminster, London. These vehicles are driven by two high-speed motors geared to the front wheels through pinions and spur wheels. As the vehicle is driven and not pushed, it has, it is claimed, no tendency to skid, while the separate drive of each of the front wheels insures that there will be no strain on the tires when turning. The use of two motors also allows series-parallel control to be employed, which is an advantage from the standpoint of traction. The energy consumption of these vehicles is well under 1 kw-hr. per car-mile.

Taking the cost of a street-sweeping machine complete with tires and battery to be $2,800, and the equipment of a garage, including charging panel, etc., as $75, the total first cost of the outfit would be $2,875. The running cost per car-mile would be made up as follows: Energy at, say, 2 cents per kw-hr., 2.4 cents; battery upkeep and renewal, 2.6 cents; tire upkeep and renewal, 0.6 cent; chassis and cleaning apparatus upkeep and renewal, 2 cents; miscellaneous material, 1.2 cents—the total being 8.8 cents. The cost per year, assuming 30 miles operation per day and 300 working days per year, with the energy and upkeep costs as quoted above, would work out as follows: Charging energy and upkeep, $792; driver at $7.50 per week, $390,

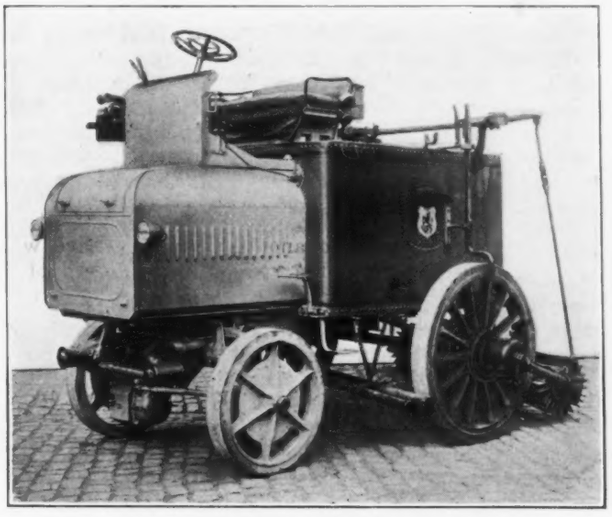


FIG. 1—ELECTRIC STREET WASHER

making the annual running charge $1,182. The interest on investment, assuming a rate of 5 per cent, would be $143.75; depreciation at 10 per cent per annum, $287.50; insurance, taxes, rent and license, $97.50, making the fixed charge $528.75. The total cost per annum would therefore be $1,710.75, and the total cost per car-mile 19 cents. Assuming that 80 per cent of the time is occupied in useful work, 83,000 sq. yd. of street surface could be cleaned per day. Making assumptions similar to those above, the running cost per car-mile with the street-washing machine works out to be 8.6 cents, the total cost per annum $1,745, the total cost per car-mile 19.6 cents, and the area cleaned per day 84,000 sq. yd.

FIG. 2—ELECTRICALLY OPERATED STREET SWEEPER

Battery manufacturers are willing to maintain the batteries in good condition at a guaranteed rate per car-mile, hence a vehicle can always be kept at its original high state of efficiency at a definite cost. Experience has proved that the cost of tire renewals is less with electric vehicles than with the internal-combustion engine-driven type, and other parts subjected to wear may be easily and cheaply replaced. The fire risk attending the use of highly volatile oil fuels is eliminated in electric vehicles and an insurance policy covering all risks can therefore be obtained at about half the rate usually charged for gasoline cars. Moreover, the operation of electric vehicles is so simple that only a short period of instruction is necessary to qualify men to

TABLE 1—DATA ON STREET-WASHING MACHINE

Test on Good Level Road	Tank Full (Drum Lifted)	Tank Full (Drum Operating)
Speed in m.p.h.	5.9	5.25
Current consumption in amperes	26 to 30	32 to 35
Energy consumption per car-mile in terms of discharge, watt-hours	370	500
Energy consumption per car-mile in terms of charge, watt-hours	500	665
Average energy consumption per car-mile, including losses in starting and on grades and bad roads, watt-hours	740	1000
Miles per charge	42	31
Miles per kilowatt-hour charge	1.35	1.0

operate them satisfactorily. Another advantage in this type of street-cleaning apparatus is that the cars can be turned round without backing in a street 18 ft. wide. As municipal work often has to be done at night, the absence of noise and odor renders these vehicles particularly adaptable to this class of service.

In the Lloyd electric street-washing machine shown in Fig. 1 two motors are employed which are rated at 2 hp each but which are capable of developing and carrying 5 hp to 6 hp. Energy is supplied to these units from a Tudor battery containing forty elements and rated at 240 amp-hr. The length of the vehicle wheelbase is 5 ft. 3 in., the gage is 4 ft. 9 in., the over-all width of the chassis is 7 ft. 5 in., the over-all length 10

ft. and the over-all height 8 ft. 6 in. The vehicle, completely equipped with battery and a 450-gal. tank full of water, weighs 11,800 lb.

Table I shows the results of a test on one of these washing machines. The surface cleaned per charge was 108,000 sq. yd., or at the rate of 3500 sq. yd. per kw-hr.

Fig. 2 shows an electric sweeping machine which weighs 5400 lb. equipped with battery. The front tires are made of solid ruber while the back wheels have steel rims. Table II contains data compiled on this machine. The area swept per charge was 76,000 sq. yd., or 2600 sq. yd. per kilowatt-hour charge.

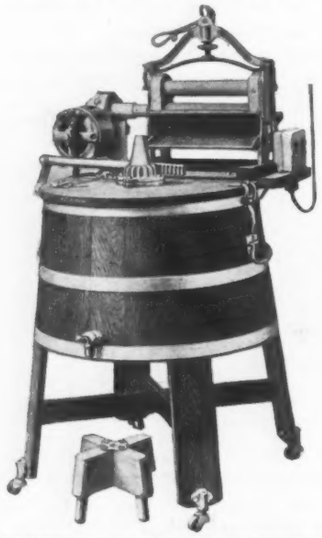
TABLE II—DATA ON STREET-SWEEPING MACHINE

Test on Good Level Road	Brush Lifted	Brush Sweeping
Speed in m.p.h.	7.25	5.6
Current consumption in amperes	32	48
Energy consumption per car-mile in terms of discharge, watt-hours	340	670
Energy consumption per car-mile in terms of charge, watt-hours	455	900
Average energy consumption per car-mile, including losses in starting and on grades and bad roads, watt-hours	680	1340
Miles per charge	46	22 to 28
Miles per kilowatt-hour charge	1.5	0.75

Vehicles of this type are being employed in several towns in Germany and other European countries, where they are giving continuously good service, so that there is every reason to believe that street cleaning can be successfully and economically performed with electrically operated apparatus.

Electric Washer with Push-Button Control

An electric washer the operation of which is controlled entirely by push-buttons has been placed on the market by the Michigan Washing Machine Company, Muskegon, Mich. All of the moving parts of this machine, which is illustrated herewith, are designed for



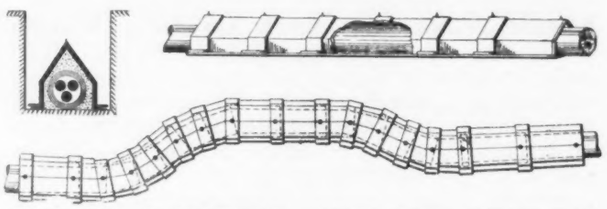
ELECTRIC WASHING MACHINE

quiet operation and are inclosed. The machine is provided with an automatic wringing release.

On page 780 of the *Electrical World* of April 4 it was stated that the washing machine shown thereon was manufactured by the above company. This was an error, the fact being that it was made by the Conlon Electric Washer Company, Chicago, Ill. Both machines are operated by Westinghouse motors.

Flexible Armor for Underground Cables

The difficulty of protecting underground cables from mechanical injury is well known. Cable coverings such as burnt clay, concrete, cement and even iron do not always give sufficient protection against mechanical injuries that may be caused by the driving of pointed iron poles when excavating for gas or water. Some of these cable coverings are not even proof against



ARMOR FOR UNDERGROUND CABLES WITH ROLLED-IRON SECTIONS

atmospheric conditions, so that in the course of time the decay which sets in may cause the coverings to part at the joints, or, when digging is required to trace defects in the cable, they may collapse at the slightest shock.

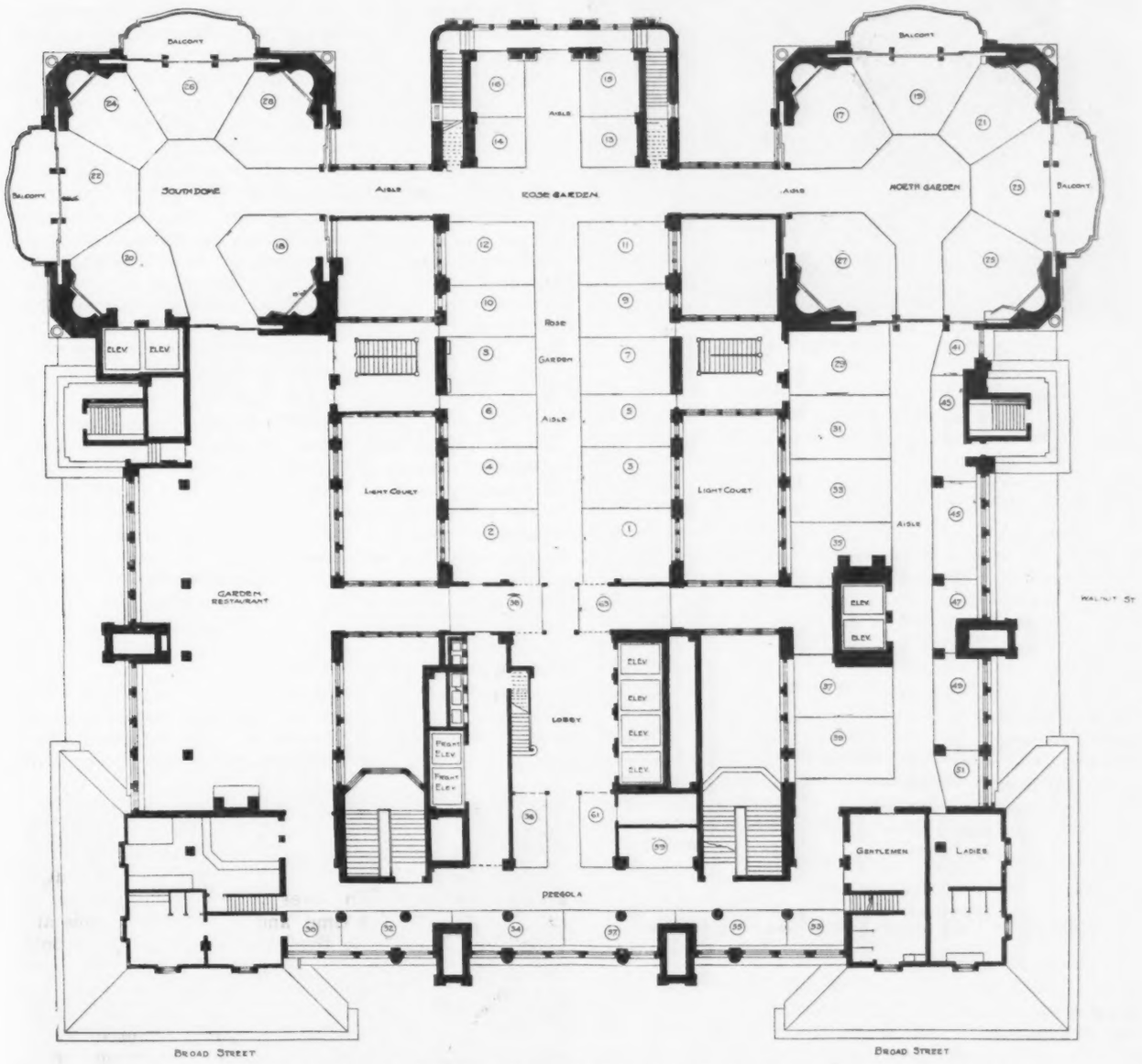
Contrivances made of iron have up to the present offered a somewhat better protection against damages of this kind, but they are not very convenient, because the cable must be laid in as straight a line as possible in order that it may be covered with relatively long-profile iron members. It is not permissible, however, to draw high-tension cables taut, on account of temperature changes. Such long-profile iron members cannot always accurately follow or yield to the proper course of the cable, and as a result the latter will in places be exposed at the joints of the conduit.

To obviate the foregoing troubles, a new type of armor duct consisting of short roof-like rolled-iron sections has been constructed, these sections overlapping and hinging together. These short A-shaped sections are linked together by studs and holes at the top ends in such a manner that one of the sections in sleeve-joint fashion alternately overlaps the end of two adjacent sections. The general style of structure is shown in the accompanying drawing. By this arrangement, which has been introduced by Messrs. Werths & Company, of London, England, the scale-armor duct can readily yield to the bends of a cable in any direction, either horizontally or vertically, and when it is required to uncover the cable all that is necessary is to lift the scale section above it. Owing to the simple construction of the duct, a single workman can cover a considerable length of cable in a very short time, and when branch lines are to be connected, or in the case of repairs, it is only necessary to lift short portions of the duct from the cable. As the profile is A-shaped, the duct effectively deflects the direction of any attacking picks or pointed poles, etc., while its joints do not, it is claimed, loosen through shock of any kind likely to be encountered in ordinary installations.

Another important point is that the roof-like iron covering makes the complete embedding of the cable unnecessary, as the latter can be interfered with only in a vertical direction, that is to say from the surface of the ground. When laying a cable across streets, to avoid interruption of traffic, the A-scales can be placed on and clamped to special rolled-iron bedplates which are supplied for that purpose, thus forming a permanent culvert for the cables. As the tarred A-scales are loosely hinged to one another, no joints can corrode or cling together, an advantage which it is worth while taking into account.

Exhibits at the National Electric Light Association Convention

The accompanying illustration shows the floor plan of the roof garden of the Bellevue-Stratford Hotel, in Philadelphia, which is to be given over for exhibition purposes during the convention of the National Electric Light Association, June 1 to 5. According to the exhibition committee, almost all of the exhibition space has already been disposed of. Appended is an alphabetical list of the exhibitors:



FLOOR PLAN OF THE ROOF GARDEN OF THE BELLEVUE-STRATFORD HOTEL, PHILADELPHIA, PA.

American Ironing Machine Company, Barnes & Kobert Manufacturing Company, Bell Electric Motor Company, James G. Biddle, *Central Station*, Century Electric Company, Cooper Hewitt Electric Company, Delta Star Electric Company, Edison Lamp Works of General Electric Company, Edison Storage Battery Company, Electric Service Supplies Company, Electric Storage Company, *Electrical Review and Western Electrician*, *Electrical World*, Federal Electric Company, General Electric Company, G & W Electric Specialty Company, Hubbard & Company, Hughes Electric Heating Company, Hurley Machine Company, H. W. Johns-Manville Company, Lombard Governor Company, Metropolitan Engineering Company, National Lamp Works of General Electric Company, Ohio Brass Company, Otis Elevator Company, Palmer Electric & Manufacturing Company, Philadelphia Electrical & Manufacturing Company, Philadelphia Storage Battery Company, Pittsburgh Transformer Company, John A. Roebling's Sons Company, Rumsey Electric Company, Sangamo Electric Company, Southern Exchange Company, Standard Underground Cable Company, Wagner Electric Manufacturing Company, Western Electric Company, Weston Electrical Instrument Company, Westinghouse Electric & Manufacturing Company, Westinghouse Lamp Company, Westinghouse Machine Company.

It is planned to have an exhibit of beauty and interest in a setting of unequaled attractiveness. The garden has a wide view over the whole city, and it has a separate restaurant. The entire convention will be housed in one building, and the facilities will be such as to minimize crowding or difficulty in circulation and to afford to the delegates every opportunity to make the convention a great success.

Jobber, Dealer and Contractor

Anticipating the Holidays with Window Displays

The problem of originating attractive designs for window displays—one which occupies a good deal of the time of electrical storekeepers—has been in part solved by Mr. Charles T. Rockwood, manager of the F.

INTERIOR OF SUPPLY STORE IN TOLEDO

Bissell Company's store in Toledo, Ohio, by dressing the windows to suggest approaching holidays. Just before Washington's Birthday the window of the Bissell electric shop was patriotically decorated in red, white and blue tissue paper, with a Bissell vacuum cleaner occupying the center of the display. This cleaner surmounted by a flag was mounted on a revolving table so that all sides of the device were shown to the passing public. The interior of the electric shop, with its comfortable reclining chairs for women customers and its neatly kept floors, is shown herewith. In addition to the manager two salesmen are on duty in the store at all times, while two other men solicit business on the outside.

The company takes great pride in its service department and boasts that it is always able to have one of its men call upon a housewife whose washing machine or vacuum cleaner needs repairing within twenty minutes from the time a telephone message reaches the store. In addition to this down-town salesroom the F. Bissell Company operates a factory and a jobbing house elsewhere in the city.

Convention of Iowa Electrical Contractors

The second semi-annual convention of the Iowa Electrical Contractors' Association will be held at Cedar Rapids, Ia., April 22 and 23, partly in conjunction with the convention of the Iowa State Section of the N. E. L. A. Following is the program:

Wednesday, April 22, 10 a. m.—Address of welcome, Mr. John Wunderlick, Cedar Rapids; response, Mr. George O. May; address of the president, Mr. M. McCarten; paper, "Modern Business Methods Applied to Electrical Contracting," by Mr. Ed. Kunkel, Davenport. Afternoon session, 1:30 p. m.—Paper, "Co-operation Between Contractors and Central Stations," by Mr. J. T. Marron, Rock Island, Ill.; paper, "Our Compensation Law and Its Application," by Mr. George A. Wrightman, Des Moines.

Thursday, April 23, 10 a. m.—Paper, "Uniform Plans and Specifications," by Mr. Floyd A. Wallace, Des Moines; paper, "A System of Bookkeeping for Electrical Contractors," by Mr. W. J. Ball, Moline, Ill. At 1:30 p. m. interurban cars will leave for trip to Iowa City to visit the state university, where a paper on "High-Tension Lightning Protection" will be read by Prof. A. H. Ford.

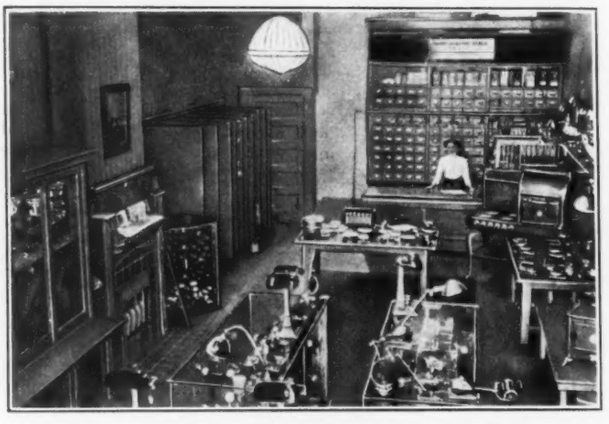
On Wednesday evening there will be a banquet, and for Thursday night a theater party is scheduled, followed by a Jovian rejuvenation.

Sales Methods and Stock Arrangements in a Cleveland Appliance Store

In the basement of the retail store of the Erner Electric Company, Cleveland, Ohio, a model laundry equipped with an electric washing machine, a motor-driven drier and electric irons has been fitted up so that customers may have a practical demonstration of the apparatus. The room is neatly finished with a concrete floor, and both hot and cold water are at hand. It is the practice of the company to send one of its wagons for the washing of the prospective customer and put it through a process of electric cleansing while the interested person is in the store. Particular attention is given to electrically operated apparatus for laundries in hospitals and similar institutions, guaranteed estimates on the cost of doing the laundry work for such places being submitted to the boards with the price of the apparatus. Mr. G. M. Siess, sales manager of the store, states that apparatus sold on this basis is making satisfied customers by effecting the saving which the company predicted.

On the ground floor, shown in the accompanying illustration, heating appliances have been arranged in glass showcases and on demonstrating tables. The bulk of this type of stock, however, is kept in a storeroom beneath. A saleslady who acts as demonstrator for household appliances is on duty at the store during shopping hours. Economy in space has been effected by attaching a complete line of sockets, receptacles and wiring devices on a set of swinging panels at the rear of the main room. Devices can be selected from this group and supplied from the stock of broken cartons kept in the small rear room on the same floor.

Co-operative meetings of the company's employees preceded by a dinner are held at regular intervals. At some of these meetings manufacturers' representatives are invited to address the company's men, and others



NEATLY ARRANGED ELECTRICAL STORE IN CLEVELAND

are given over to discussions of problems arising in the organization. Among the employees much credit for the existing co-operative spirit is attributed to the democratic attitude of the president of the company, Mr. C. T. McKinstry, who, it is said, never passes one of his own men on the street without a cheery hail and a word of encouragement.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

New York State Farmers Buy Lighting Equipment.—Mr. R. V. Sutliffe, of 136 Liberty Street, New York, has recently returned from a successful trip through New York State in the interests of the Dayton Electrical Manufacturing Company. On this trip he secured orders for a number of that company's small lighting plants and found among the farming population a very general satisfaction with present conditions. This coincides with his own experience in the handling of several lines of electrical apparatus in and around New York City.

Habirshaw Wire Company Breaking Even.—Questioned as to the business outlook in general and of his own company in particular, Mr. J. B. Olson, of the Habirshaw Wire Company, stated to an *Electrical World* representative that the general dullness is shared in by that company and that a period of real activity is not expected until July or August at the earliest. He said that by continual activity sales have been kept to a fair level, but this business has consisted of frequent orders of small size rather than of substantial sales. Accompanying the increased activity of the sales force, the production force has been worked somewhat under capacity. Mr. Olson feels that his company is at least breaking even and that there is a real prospect for better business later on in the year.

Westinghouse Lamp Factory in Milwaukee.—Further advices in relation to the new electric incandescent-lamp factory of the Westinghouse Lamp Company in Milwaukee, to which references in the *Electrical World* have appeared in the issues of Jan. 24 and March 28, are to the effect that the company has obtained possession of a building at Thirty-second and Center Streets, Milwaukee, originally occupied by the Romadka Brothers' Trunk Company. The Westinghouse Lamp Company is now equipping this factory for the manufacture of Westinghouse tungsten lamps. It is believed that when the plant is in full operation it will be equal to a daily output of 20,000 lamps and will furnish employment for about 500 hands. Irving B. Cary, representing the executive officers of the Westinghouse Lamp Company, is in charge of the establishment of the new factory.

Application of Lock Lamp Sockets.—The Best Electric Company, of Pittsburgh, Pa., gives the field of application of its lock lamp socket, in the use of which the lamp has to be broken in order to remove it and insert another. The lock socket is furnished in either brass, porcelain or composition, with or without key switch for turning the light off or on, and in brass only with or without special key release attachment. The company finds that in places where expert mechanical labor is not employed the lock socket with key release, which permits the removal of the lamp without breaking, is very satisfactory. Where high-grade mechanical labor is employed, however, as in railroad and machine shops and tool rooms, the key-release attachment lessens the efficiency of the lock, since keys can be made by unscrupulous workmen. Both kinds of these lock sockets are enjoying a good sale.

Outlook in Electric Specialty Field.—The firm of Harvey Hubbell, Inc., of Bridgeport, Conn., has recently developed a new type of polarized plug and receptacle for three-wire work, the sale of which is promising. In general this company is finding business very dull, and it has recently increased its sales force in an effort to work the existing demand more intensively. The dullness is not confined to its sales in the metropolitan district, but is widespread. In some sections of Ohio, in the Northwest and in part of the South the greatest recent activity has been noticed by this concern, but even in those places no phenomenal sales have been enjoyed. Some time ago plans were laid by the Hubbell company for an increase in its factory facilities, to be made at about this time, but the protracted dullness has caused the abandonment of these plans, at least temporarily, and the present production force is somewhat under normal.

New Chicago Storage-Battery Factory.—Removing from its former quarters at 1631 South Michigan Avenue to a modern brick and concrete structure at the corner of West Lake and Albany Streets, Chicago, the Petschel Storage Battery Company has begun the manufacture of storage batteries and will soon begin to make small farm-lighting sets and switchboards. The building now occupied is a fireproof structure measuring 100 ft. by 180 ft., in ground dimensions and with one 18-ft. story. When running at full capacity the factory, it is said, will be able to manufacture about 10,000 plates a week. It is affirmed that the plates used in the Petschel batteries contain a patented paste of new composition allowing the batteries to be formed within from fourteen hours to sixteen hours after the pasting process has been completed. In addition to this feature tests on the plates are said to show higher relative ratings than have hitherto been obtained.

Electric Controller Manufacturer Prospering.—A short time ago the Electric Controller & Manufacturing Company, of Cleveland, Ohio, completed a new five-story addition to its factory which increased the working space about 30 per cent. The interests of the employees have been advanced in this connection by the installing on the top floor of this new building of a large dining room, open to all who choose to use it. The company has had very satisfactory sales recently, among the most important being the furnishing of the complete control equipment for the electric cranes, mill tables, hoists and auxiliary motor drives in the plant of the Minnesota Steel Company, at Duluth, Minn. In the new merchant mill of the Bethlehem Steel Company all of the mill tables are controlled by this company's magnetic-switch-type controllers, with series-wound accelerating switches. The blooming-mill manipulators in the same works are operated by this company's magnetic controllers with a specially developed torque limit relay. This relay made it possible to adapt motor drive to this service, which formerly required hydraulic shifting mechanisms.

Spring Business of the Hurley Machine Company Excellent.—Mr. Niel C. Hurley, who is in charge of the New York office of the Hurley Machine Company, at 949 Broadway, New York City, likes the way business has opened up this spring for his company's product of washing machines and vacuum cleaners. The March sales of washing machines were the largest the company has ever had in the same period, and the sale of its vacuum cleaners has been fully as satisfactory. The latter are put out for free trial, and the sale through this method in many cases runs as high as 70 per cent of the machines placed out. It is considered to be the company's best merchandising method on this class of goods. Questioned concerning the progress of the commission sent by the Illinois Manufacturers' Association in February to investigate South American trade and industrial conditions, Mr. Hurley replied that so far he had received only the most meager details from the party, and that these included nothing concerning these conditions. Mr. E. N. Hurley, president of the Hurley company, was the official head of this party and carried a special commission from Secretary Redfield as a representative of the United States government. Although the complete itinerary of the party will consume several more months, Mr. Hurley's return to the United States is expected in a short time.

Manufacturer Advocates Renting of Interchangeable Signs.—Harvey Deschere, of Harvey Deschere & Company, 50 Church Street, New York, manufacturers of the Argus miniature electric signs, explained to an *Electrical World* representative this week a new plan which he has developed to bring his product to the favorable attention of the users of such signs. The initial cost of his product is somewhat higher than that of other similar apparatus on the market, which has made his selling problem more difficult. Three selling plans have been inaugurated as the opportunities for expansion grew. In the first place, the usual cash payment plan was used and continues to be used to some extent. To meet a demand for credit a deferred-payment plan was then adopted, allowing the initial cost to be spread over a definite period and met in small amounts. The company has now brought forward a leasing plan, which it says is the most satisfactory of the three, both from its own and from the customers' standpoint. By this plan for regular payments of a very small percentage of the cost of the apparatus, if bought outright, signs can be obtained of various sizes and for various lengths of time, as required, enabling their economical use for special sales, expositions and similar work. This plan has worked well so far and is expected greatly to increase the company's business. In order to aid in the pushing of this and the other selling plans, the company is now increasing its sales force. Since the beginning of the year the concern's factory has been in the Factory Terminal Building, at 1507 Garden Street, Hoboken, N. J., and after May 1 the main office will be located there also and the New York office discontinued.

Statement of the Copper Producers' Association for March

A tremendous export of copper during the month of March was shown by the report for that month of the Copper Producers' Association. This movement was accompanied by a large increase in production and in domestic deliveries, but as predicted in the March 14 issue of the *Electrical World*, the stocks on hand at the end of that month were still further reduced. The increase in production and in domestic consumption seemed fairly probable, but the large increase in foreign deliveries was unexpected. The complete figures for March are as follows:

	March, pounds		February, pounds	
Stocks on hand in the United States on first of month.		78,371,852		87,296,685
Production		145,651,982		122,561,007
		224,023,834		209,857,692
Domestic deliveries.	69,852,349		47,586,657	
Foreign deliveries...	89,562,166		83,899,183	
		159,414,515		131,485,840
Stocks on hand at end of month.....		64,609,319		78,371,852

NEW YORK METAL MARKET PRICES

Copper:	Mar. 31 Bid	Mar. 31 Asked	Apl. 7 Bid	Apl. 7 Asked
Standard spot*	13.80	14.30	13.87½	14.37½
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard, spot*....	65 2 6		65 15 0	
Prime Lake	14.75	to 14.87½	14.75	to 15.00
Electrolytic	14.40	to 14.50	14.45	to 14.55
Casting	14.20	to 14.30	14.25	to 14.35
Copper wire base.....	15.50	to 15.75	15.75	to 15.87½
Lead		3.80		3.80
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter....		7.00		7.00
Spelter, spot	5.32½	....	5.32½	....
Tin, spot	37.85	to 38.25	36.55	to 36.85
Aluminum:				
Prompt delivery	18.00	to 18.25	18.00	to 18.25
Future	18.00	to 18.25	18.00	to 18.25

***OLD METALS**

Heavy copper and wire	13.62½	13.62½
Brass, heavy	8.62½	8.62½
Brass, light	7.62½	7.62½
Lead, heavy	3.80	3.80
Zinc, scrap	4.25	4.25

***COPPER EXPORTS**

Total tons to Apl. 7.....6,119

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

General Electric to Pay Off Maturing Notes from Cash in Its Treasury.—The eight-million-dollar issue of General Electric nine-month notes, maturing April 16, is to be paid off from cash in that company's treasury.

Receiver for Ohio Hydroelectric Plant.—The Sandusky River Power Company, which owns the hydroelectric plant south of Fremont, Ohio, has been placed in the hands of B. J. Jones as receiver. The application for a receivership was made by a local stone company which has a claim of $891.

New Capital Required for Lighting Companies.—Government statistics relating to the revenue for strictly lighting and motor service show that the gross for the United States is now about $30,000,000 per month. Statistics collected by the *Electrical World*, covering a large proportion of the operating companies and groups of companies having gross monthly incomes of $100,000 or more, indicate that the gross income for lighting and motor service during February, 1914, was 10 per cent in excess of the corresponding income during February, 1913. When it is remembered that every dollar per year of new business requires from $5 to $10 of new capital investment, and that the normal increase in earnings of the electric energy supply companies is around $4,000,000 per month, some idea will be gained of the magnitude of the never-ending demand of this industry for new capital.

Offer of Denver Notes.—Henry L. Doherty & Company offer $3,500,000 Denver Gas & Electric Light Company collateral trust 6 per cent gold notes at 99 and interest. The notes are dated April 1, 1914, and mature in three years. They are callable on any interest date on sixty days' notice at 101 and interest. Principal and interest of the notes are guaranteed by the Cities Service Company. The notes are secured by deposit of $5,752,000 first and refunding mortgage 5 per cent bonds of the company and $936,000 general mortgage 5 per cent bonds of the Denver Gas & Electric Company. A letter from Frank W. Frueauff, president of the company, states that the gross earnings for the year ended Dec. 31, 1913, were $3,161,763. Expenses for operation and maintenance and taxes were $1,779,093, leaving net earnings of $1,382,670. Bond interest was $358,645, leaving a balance applicable to interest on this issue of $1,024,025.

Wisconsin Edison Company Securities Offered.—A letter issued to shareholders of the North American Company by James D. Mortimer, the president, offers them an opportunity to subscribe for debenture bonds and capital stock of the Wisconsin Edison Company. This company was organized under the laws of New York and owns all of the securities of the following companies which were formerly owned by the North American Company: The Milwaukee Electric Railway & Light Company, Milwaukee Light, Heat & Traction Company, Wisconsin Gas & Electric Company, Watertown Gas & Electric Company, Burlington Electric Light & Power Company, North Milwaukee Light & Power Company and Wells Power Company. The capitalization of the Wisconsin Edison Company consists of $10,000,000 authorized ten-year 6 per cent convertible gold denbenture bonds dated May 1, 1914, of which $6,500,000 are issued, and 400,000 shares of capital stock without nominal or par value, of which 215,000 shares are issued. All of the issued securities are owned by the North American Company. The opportunity offered to shareholders is to subscribe pro rata in proportion to their holdings for $3,000,000 debenture bonds and 30,000 shares of the stock. The holder of each ten shares of North American stock may subscribe for $100 debenture bonds and one share of capital stock for $136. Regular dividends of $3.50 per share annually are being paid upon the stock. The subsidiary utilities of the Wisconsin Edison Company serve a population estimated at 580,000. All the electric lighting, gas and heating franchises are in the form of indeterminate permits. A description of the company, inclosed with the letter of Mr. Mortimer, states that the street railway franchises are of long duration and may be surrendered at any time and indeterminate permits obtained in lieu thereof. Gross earnings of the subsidiary utilities have shown a large growth. They have increased from $1,891,551 in 1898 to $8,495,324

in 1913. Earnings for the twelve months ended Feb. 28, 1914, available for the payment of interest on the debentures of the Wisconsin Edison Company and dividends on its stock and for depreciation of subsidiary utilities were $2,087,559. Interest on the debentures and regular dividends on the stock yield about 7 per cent on the purchase price of the securities. Reserves of the subsidiary utilities aggregate over $4,715,000, and the book surplus accounts are in excess of $2,146,000.

American Power & Light Company and Subsidiaries.—A pamphlet report giving various details about operations has been issued to stockholders of the American Power & Light Company. It covers operations of that company and its subsidiaries, the Kansas Gas & Electric Company, the Pacific Power & Light Company, the Portland Gas & Coke Company and the Southwestern Utilities Corporation, for the year ended Dec. 31, 1913. F. G. Sykes, the president, states that the policy of acquiring property and of building for the future has been continued, and the amount of the present cash investment not yet materially productive is approximately $4,521,000. The subsidiary companies supply electric light and power service to eighty-nine communities, and in addition other public utility services to a number of the communities. The total population served is estimated at 850,000. There were 61,378 electric customers in 1913. Of the total developed electric power capacity of approximately 78,200 hp, 20,760 hp was generated by hydroelectric plants. The capacity in operation at the end of the year was 58,340 kw, while there were under construction facilities for 16,460 kw additional. There were in operation 702 miles of high-voltage transmission lines while 83 miles were under construction. Earnings from electric light and power companies comprised 55 per cent of the total gross revenue. Gross earnings of the operating companies for 1913 were $5,864,165, an increase of 9.7 per cent over 1912. Net earnings were $2,678,831, an increase of 12.6 per cent over the previous year.

Standard Gas & Electric Company to Retire Notes Before Resuming Dividends.—President H. M. Byllesby, of the Standard Gas & Electric Company, presented the annual report to the stockholders for the year 1913 on March 23. The total estimated population served by the subsidiary properties is 876,027. The "applicable income" from the subsidiaries is given as $1,933,624. From this there was deducted $787,804 for operating expenses, interest charges, etc. This leaves $1,145,820. The sum of $912,420 is required for the 8 per cent dividends on the average amount of preferred stock outstanding during the year. This leaves a balance of $233,400, equivalent to 2.5 per cent on the common stock outstanding during the year. However, the subsidiary companies did not pay out all the "applicable earnings" in dividends, but allocated certain sums to depreciation and surplus. Therefore the actual income of the company was $1,539,311. Deducting from this operating expenses, interest charges, etc., as stated, leaves a balance of actual income of $751,507. The company paid on the preferred stock cash dividends of $362,456 and scrip dividends of $549,964. These exceed the actual income for the stock by $160,914. This excess amount was charged to the company's previously accumulated surplus. Following the plan of depositing $75,000 per month to retire the notes due June 1, 1914, $225,000 notes had been retired at the date of the report. The financial condition of the subsidiary companies was reported as good. The directors deem it imprudent to resume cash dividends until the collateral trust notes are entirely retired.

Western Union Telegraph Earnings.—Total gross earnings of the Western Union Telegraph Company in the year ended Dec. 31, 1913, were $45,783,512. The income account for the year was reclassified so as to treat amounts paid other lines for the transmission of messages and refunds made in connection with services rendered, aggregating $1,110,517, as deductions from total earnings rather than as expenses, which had been the practice. The increase in earnings over the preceding year was 3.9 per cent. Operating expenses increased 4.2 per cent. The balance of income after payment of the 3 per cent dividend on the stock was $242,671. Net additions to the property account for the year were $3,761,496. There were added to the land-line plant 623 miles of pole and 18,458 miles of wire. This was made up by an increase of 25,797 miles of copper wire and a decrease of 7339 miles of iron wire. The company has 25,060 independent and joint offices. Considerable work was performed during the year in the improvement and rehabilitation of offices, in moving them to more desirable locations and in closing others which were not remunerative. Inventories were taken of all materials and supplies in the field and warehouses as of Nov. 30, 1913, and the amount shown in the balance sheet is the cost value thereof less adequate reserves to provide for any depreciation in values. Litigation between the American Speaking Telephone Company *et al.* and the American Bell Telephone Company on the contract of Nov. 10, 1879, was finally concluded in 1913 in favor of the former company. The Western Union company received as dividends $3,230,545. This was credited to surplus reserve. The balance sheet shows reserves as follows: For maintenance of cables, $1,676,926; for reconstruction of land lines, $2,168,084; for employees' benefit fund, $1,000,000.

Annual Report of United Gas & Electric Corporation.—The annual report of the United Gas & Electric Corporation for 1913 says that during the year more than $3,000,000 was expended for additions, betterments and extensions in the railway, gas and electric and water departments. Of this amount $1,200,000 was expended on the International Railway, Buffalo, and $474,000 on the Harrisburg Light & Power Company. George Bullock, the president, states that ample expenditures have been made out of earnings to maintain the physical condition of the property and in addition that an adequate reserve has been set aside during the year to provide for renewals and replacements. Notwithstanding the depression in the last quarter and the increased cost of labor, fuel, oil and taxes, which added $229,000 to expenses during the year, net earnings increased. Officers of the company believe that the cost of raw material has reached the maximum and that the tendency, the signs of which have already shown themselves, will be toward a reduction in price, which they hope will tend to a saving in operating expenses. Over 95 per cent of the total outstanding common stock of the American Cities Company has been exchanged for United Corporation stock under the offer made on Sept. 25, 1913. The directors are of the opinion that the properties thus controlled will prove to be valuable acquisitions. A consolidated surplus account is published for the United Gas & Electric Corporation and the subsidiary United Gas & Electric Engineering Corporation covering the year 1913. The surplus on Jan. 1, 1913, was $56,691. Dividends of subsidiary companies actually declared during the year and miscellaneous direct earnings, after deduction of expenses, amounted to $876,183. From this there were deducted $302,225 interest and $556,188 preferred dividends, a total of $858,413. This left a balance of $17,771, or, with the surplus as of Jan. 1, a total of $74,462. There was deducted $18,332 discount on coupon notes negotiated during the year less profits on transactions in bonds of underlying companies, less a profit of $70 made by the engineering corporation on the sale of notes, or $18,262. The surplus on Dec. 31, 1913, therefore, was $56,200. There was also published a statement of earnings from all sources. This shows direct earnings less expenses of $1,184,434. This amount is stated as earnings of the corporation and net earnings of subsidiary companies after deduction of dividends on their preferred stock, including the equity of the direct subsidiary companies in the operations of their respective subsidiary companies calculated on the basis of their holdings at the end of the period and after providing reserves for the federal income tax on main holding companies amounting to $11,355. Interest and preferred dividends of the United Gas & Electric Corporation aggregated $858,413, leaving net surplus earnings of $326,021, of which $308,251 was added to the surplus account of the subsidiary companies, not declared as dividend. Out of this sum and previous accumulations of surplus of subsidiary companies there were charged during the year various amounts on account of extraordinary expenditures not directly applicable to operations for the year, of which the proportion corresponding to the holdings of this corporation was $153,838. The combined properties of the United Gas & Electric Corporation and the American Cities Company showed an output of 430,107,920 kw-hr. compared with 405,643,998 kw-hr. in the preceding year. The number of electric meters in use was 88,396.

Business Notes

The Columbia Lamp Division of the National Lamp Works of the General Electric Company has moved its New York branch office to 68 West Thirty-eighth Street.

The Shelton Electric Company has announced the removal of its office on April 15 to the Forty-second Street Building, 30 East Forty-second Street, New York City.

The S. W. Electric Company, of 42 Lexington Avenue, New York City, has announced its removal to 652 Hudson Street in the same city. This concern manufactures electrically heated tools and reconstructs other makes of tools for electric heating.

The Covington Machine Company, of Covington, Va., has secured as its general manager A. P. Montague, who has been for the past ten years associated with the Lynchburg (Va.) Foundry Company, occupying at the time of his departure the position of general superintendent of that company.

The Dietz-Warner Electric Company has been formed with headquarters at 195 Second Street, Milwaukee, Wis., and will do an electrical supply, contracting and repairing business in that neighborhood. C. L. Dietz, president of the company, was formerly with the Commonwealth Power Company. J. J. Warner is vice-president and Oscar Wuesthoff secretary-treasurer of the new organization.

The Taylor Underground Heating System, of Pittsburgh, Pa., has engaged T. E. Keegan as assistant manager to represent the concern among architects and engineers in all the large cities of the United States. Mr. Keegan has served with the Atlas Engine Company, the American Stoker Company, the Consolidated Engineering Company of Chicago and the Open Coil Heater & Purifier Company.

The E. W. Ham Electric Company was recently incorporated for the purpose of conducting an electrical jobbing business, and its present address is 5 Barton Place, Worcester, Mass. J. B. Bailey, formerly of the Stuart-Howland Company, of Boston, is president of the new concern, and E. W. Ham is treasurer. This company took over the electrical jobbing business formerly owned by Mr. Ham and plans to extend it.

The Viking Electric Company, manufacturer of Viking bell ringers and other products, in order to take care of a rapidly growing business, is moving its plant from Albany to 292 Taaffe Place, Brooklyn, N. Y. The new plant, containing twice as much floor space as the old plant, will be equipped with additional machinery and more help will be taken on. The present sales office at 150 Chambers Street, New York, where a large stock is carried, will be maintained.

New Industrial Companies

The Ex-El Electric Company, of Cleveland, Ohio, has been incorporated with a capital stock of $10,000 by L. J. Kohn, J. S. Kohn, L. M. Young, L. C. Maisner and J. B. Dwerken. The company proposes to manufacture and deal in electric devices.

The Harmo Electric Company, of Chicago, Ill., has been incorporated wth a capital stock of $10,000 to manufacture and deal in musical instruments, machines and devices. The incorporators are Roy M. Harmon, M. V. Lyons and H. R. Frey.

The Electro-Acoustic Company, of New York, N. Y., has been incorporated with a capital stock of $100,000 for the purpose of manufacturing apparatus for receiving and recording sounds. The incorporators are R. M. Mitchell and A. F. Gerstner, of Newark, N. J., and W. P. Andrick, of New York, N. Y.

The V. M. Nussbaum Company, of Fort Wayne, Ind., has been incorporated to deal in electrical supplies. The company will take over the electrical department of the Hanna-Brackenridge Company, which Mr. Nussbaum has purchased from the trustees in bankruptcy of the Hanna-Brackenridge Company. The directors are V. M. Nussbaum, L. P. Nussbaum and J. W. Thompson.

Trade Publications

Electrical Supplies.—The Pacific States Electric Company, San Francisco, Cal., has recently issued some additional leaves for its loose-leaf catalog. These loose leaves supersede others covering the same items.

Conduit.—A small folder recently issued by the American Conduit Manufacturing Company, Pittsburgh, Pa., tells briefly about the prominent characteristics of Wireduct, a flexible conduit. A price list is also given.

Oil Switches.—The General Electric Company has just issued a bulletin, illustrating and describing its Type F, Form K12 oil switches. This contains up-to-date information on a very important piece of electrical apparatus.

Guy Anchors.—The Oshkosh Manufacturing Company, Oshkosh, Wis., has issued a folder describing and illustrating the Oshkosh guy anchor. Exceptionally great expansion is claimed for this device, and tests have shown that it has good holding power in all kinds of soil.

Switchboard Panels.—Section DS 1410, a Westinghouse publication, covers direct-current switchboard panels for 100-volt and 220-volt systems. A detailed description is given of the various apparatus mounted on the boards, and sketches are shown of the arrangement furnished on standard panels.

Switches and Receptacles.—A neat booklet of twenty pages has been published by the Metropolitan Electric Manufacturing Company, East Avenue and Fourteenth Street, Long Island City, N. Y., which is devoted to its detachable mechanism push-button switches, lock switches and flush receptacles. These devices are illustrated, and a price list is given.

Rectifiers.—The alternating-current rectifier for charging storage batteries which is manufactured by the Mohawk Electric Manufacturing Company, Newark, N. J., is the subject of a clearly written pamphlet. The information that the user and prospective user want to have about this apparatus is given in a practical manner, accompanied by illustrations.

Wiring Specialties.—Bulletin No. 8, recently brought out by the Connecticut Electric Manufacturing Company, Bridgeport, Conn., combines all bulletins and describes new specialties not listed in its Catalog No. 4. The present publication contains sixteen pages and illustrates the company's latest types of push-button switches, conduit receptacles, rosettes and other wiring specialties.

Silent Chain Drive.—Data Book 125, lately issued by the Link Belt Company, of Chicago, Ill., contains a compendium of information on chain-belt drive for all kinds of service. Price lists and dimensions of the various designs of this company's product are contained in the book, together with numerous descriptions of chain-belt installations. The book is well illustrated.

Lighting Supplies.—The Federal Sign System (Electric), Lake and Desplaines Streets, Chicago, Ill., has issued a large-size "bargain list," which contains illustrations and prices of articles of which the company has an over stock. There is a limited number of each class of goods, and they are offered at special prices. Indirect fixtures, portables, lamps, signs, sockets and other specialties are among the offerings.

Steel Poles.—The Franklin Steel Company, Franklin, Pa., has issued an attractive sixteen-page catalog devoted to its "Tripartite" steel pole and rolled-steel specialties. The adaptability, durability and first cost of steel poles are discussed. Among the excellent illustrations is one showing the 55-ft., 40,000-volt transmission line installed by the United States government in Arizona, for which steel poles are used.

Safety Device.—The Draeger Oxygen Apparatus Company, 422 First Avenue, Pittsburgh, Pa., is sending out printed information regarding the new Draeger "self-rescuer." This device is in extensive use for prompt rescue work in mines, metallurgical and chemical plants and gas companies. The pamphlet contains a description of the working principles of the apparatus and instructions for use. An illustration is shown of a Draeger two-hour mine rescue apparatus in service.

Personal Mention

Mr. R. A. Long has been appointed superintendent of the municipal electric light and water plant at Cuyahoga Falls, Ohio.

Mr. Claude H. Shepherd has been appointed electrical engineer in charge for the Commissioners of Lincoln Park, Chicago, Ill.

Mr. Allan Pierson has been appointed general superintendent of the Weston (Ont.) Electric Light & Water Works Commission.

Mr. H. C. J. Peisch has been made superintendent of the Chippewa Valley Railway, Light & Power Company, of Chippewa Falls, Wis.

Mr. Sidney Allen has been appointed secretary and treasurer of the Corpus Christi (Tex.) Ice & Electric Company to succeed Mr. E. A. Born.

Mr. Lloyd Kerns has been made superintendent of the municipal electric-light plant of Logansport, Ind., as successor to Mr. J. H. Stewart, resigned.

Mr. E. A. Born, formerly secretary and treasurer of the Corpus Christi (Tex.) Ice & Electric Company, has been appointed vice-president and manager.

Mr. Leonard Work has resigned from the engineering and construction departments of the Isthmian Canal Commission and will spend four months in Europe.

Mr. Lewis A. McArthur, formerly assistant to Mr. J. E. Davidson, general manager of the Pacific Power & Light Company, Portland, Ore., has been made assistant general manager of the company.

Mr. H. E. Johnson, formerly assistant superintendent of the Canton (Miss.) Electric Light and Water Works, has been elected superintendent of the Senatobia (Miss.) Electric Light and Water Plant.

Mr. D. F. McGee, chief engineer of the Pacific Power & Light Company of Portland, Ore., has resigned to accept a position with Mr. G. E. Claflin, vice-president of the Electric Bond & Share Company.

Mr. J. C. Martin, formerly assistant in the engineering department of the Pacific Power & Light Company, Portland, Ore., has been appointed engineer of the company, vice Mr. D. F. McGee, resigned.

Mr. J. B. Woodyatt, for many years superintendent of the Sherbrooke (Que.) Railway, Light & Power Company, has resigned to accept a position with the Southern Canada Power Company, Montreal, Quebec.

Mr. F. W. Harris, who was formerly superintendent of the Coatesville (Pa.) plant of the Chester Valley Electric Company, has been appointed general manager of all the properties of the Chester Valley Company.

Mr. James T. Lynn, who is the head of a syndicate operating a number of electric plants throughout the country, has been reappointed a member of the Detroit (Mich.) Public Lighting Commission for a term of six years.

Mr. E. W. Trafford, who has been acting as manager, superintendent and consulting engineer of the municipal electric light and water plant at Richmond, Va., was made superintendent and city electrician on April 1.

Mr. George S. Searing, Chicago manager for the Hart & Hegeman Manufacturing Company, is confined to his home by illness. Mr. Searing is one of the best known of the older electrical men in Chicago and has the genuine sympathy of many friends.

Mr. H. D. Johnson has resigned his position with the Canadian British Insulated Company to join the engineering staff of the Eugene F. Phillips Electrical Works as assistant contracting manager. Mr. Johnson is considered one of the best authorities on underground distribution in Canada.

Mr. Frederick D. Adams celebrated his twenty-fifth anniversary with the United Illuminating Company of New Haven, Conn., on April 1. Mr. Adams, who is the secretary and treasurer of the company, is the oldest employee in point of service with the exception of Mr. James English, the president.

Mr. Charles D. Calkins has been appointed superintendent for the North Missouri Light & Power Company at New London, Mo. This company, which began construction work on April 1, has franchises in Perry, Center, New London and Frankford, and it will distribute energy purchased from the Mississippi River Power Company.

Mr. Leonard Day, who recently resigned as electrical engineer of the Bureau of Fire Alarm and Telegraphs of the Fire Department of New York City, was presented with a diamond watch fob by the members of the Fire Alarm and Telegraph Bureau as a token of their appreciation and in commemoration of many pleasant years spent with them.

Mr. W. R. Minor has just been appointed manager of the Holophane Works of General Electric Company to succeed Mr. V. R. Lansingh. Mr. Minor has been connected with the Holophane Works during practically all of his business career and is known throughout the country as a type of the progressive young business man and as a remarkably successful sales manager.

Mr. Edward J. Wright has been appointed chief engineer of the Tygert Allen Fertilizer Works of the American Agricultural Chemical Company at Greenwich Point, Philadelphia. Mr. Wright, who was born in Charlottesville, Va., and educated at the Philadelphia High School, will overhaul the large and complex plant at Greenwich Point, comprising a network of both alternating-current and direct-current lines and a complete electric-car-conveyor system, together with several miles of pipe lines and acid-handling apparatus.

Mr. William Weedon Cole, for many years connected with the Elmira (N. Y.) Water, Light & Railroad Company, and more recently with Messrs. Day & Zimmerman, engineers, of Philadelphia, has retired from the latter organization and will devote his entire time to investigation of reports of public utilities, industrials and advising in regard to the reorganization and mechanical operation of railroads. He has opened an office at 43 Exchange Place, New York City, for the practice of a general consulting engineering business.

Mr. J. E. Davidson, vice-president and general manager of the Pacific Power & Light Company, Portland, Ore., and heretofore in charge of maintenance and operation, has received jurisdiction over engineering matters as well, so that he will now have complete control over all engineering, operating, new-business, purchasing and tax and property departments of the Pacific Power & Light Company. Mr. Davidson, who is well known in central-station circles as one of the most progressive public utility managers of the country, became associated with the Pacific Power & Light Company four years ago in the capacity of new-business manager. He was formerly with the public utility companies at Port Huron, Mich., and Montpelier, Vt., and was president of the Vermont Electrical Association in 1909, president of the New England Section of the National Electric Light Association in 1910-1911, and president of the Northwest Electric Association in 1911-1912.

J. E. DAVIDSON

Mr. E. W. P. Smith has been appointed city electrician of Cleveland, Ohio. Mr. Smith was graduated in electrical engineering from the Colorado College in 1908, and after a year of operating experience in the West entered the railway engineering department of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa. He was later employed by the city of Cleveland in the smoke-prevention division, where a preliminary report on the electrification of steam railroads in the city of Cleveland was prepared. During the latter part of 1913 Mr. Smith was in the mechanical department of the Lake Shore & Michigan Southern Railroad. He is an associate of the American Institute of Electrical Engineers, a member of the Electrical Railway Association and a member of the Cleveland Engineering Society.

Construction

New England

LEWISTON, MAINE.—The Lewiston & Auburn El. Lt. Co., of Lewiston, is contemplating the installation of a steam-power plant in the Lincoln mill property which will develop from 6000 hp to 8000 hp.

KEENE, N. H.—The Public Service Commission has granted the Keene Gas & El. Co. permission to issue $150,000 in capital stock, of which $50,000 will be used to take up preferred stock outstanding, the remainder for the purpose of taking up outstanding notes issued for additions and improvements to property and for working capital.

BRADFORD, VT.—The Bradford El. Ltg. Co. expects to purchase within the next two months one car load of cedar poles. A. F. Dickey is manager.

BRANDON, VT.—The Hortonia Pwr. Co., of Brandon, recently incorporated, has acquired a series of ponds and lakes situated in Hubbardton and Sudbury, Vt., and purposes to build a hydroelectric power plant at Hortonville at the outlet of Lake Hortonia. The power house will be of concrete construction, situated 1200 ft. from the dam, between which and the power house will be laid a steel penstock 54 in. in diameter. The initial installation will consist of a 500-hp turbine directly connected to 2300-volt, three-phase, 60-cycle generators. Energy generated at the plant will be transmitted to Brandon at 11,000 volts, where the company has a long-term contract with the Neshobe El. Co., of this town. Transmission lines will also be erected to Sudbury and Orwell. Among the incorporators of the Hortonia Co. are Edward D. Blackwell, of Brandon; A. W. Hyde, of Sudbury, and W. A. Jennings, of Orwell.

HEARTWELLVILLE, VT.—It is reported that W. B. Plunkett, of Adams, Mass., will establish an electric-power plant to furnish electricity to light his summer home in Heartwellville. The output of the plant, it is understood, will be sufficient to furnish electricity in the village in case electrical service is wanted.

WHITE RIVER JUNCTION, VT.—Within the next four months the Mascoma El. Lt. & Gas Co., of White River Junction, expects to purchase material for distribution system (2½ miles) and 40 brackets for tungsten lamps. Frank Collins is general manager.

BOURNE, MASS.—C. D. Parker & Co., 78 Devonshire Street, Boston, Mass., it is reported, contemplate the construction of a power plant near Bourne to furnish energy for the proposed canal electric railway and for manufacturing purposes.

GEORGETOWN, MASS.—The town of Georgetown has applied to the State Legislature for permission to furnish electricity in the towns of Boxford and Newbury. It is proposed to erect transmission lines from the municipal electric-light plant to the above towns and install distributing systems in each place.

OAKHAM, MASS.—A committee, consisting of Gardner M. Dean, Gilbert C. Butterfield, John P. Day, Clarence H. Parker and Walter R. Dean, has been appointed to investigate the feasibility of establishing a municipal electric-light plant in Oakham.

SPRINGFIELD, MASS.—Bids will be received by the committee on city property for the city of Springfield until April 16 for two steam engines and generators for the High School of Commerce, Springfield. Drawings and specifications may be seen at the office of Kirkham & Parlett, architects, Carr Building, Springfield. George S. Cook is chairman of committee.

WOONSOCKET, R. I.—Contracts have been placed by the Blackstone Valley Gas & El. Co., of Woonsocket, for material for the ornamental lighting system, consisting of 39 General Electric 4-amp luminous inverted arc lamps, erected on ornamental brackets on present poles, maintained by overhead wires. The cost of the work is estimated at $3,000. A. F. Townsend is local manager.

MANCHESTER, CONN. — Preparations are being made by Cheney Brothers to build a new weaving shed, 150 ft. by 321 ft., for its velvet manufacturing plant and a yarn-dyeing house, 80 ft. by 326 ft. A temporary boiler house will be built in the rear. The company purposes to build, some time in the future, a central heating and power plant to supply all its mills. The new mills will be operated by electricity.

MERIDEN, CONN.—The Board of Public Works has authorized W. S. Clark, superintendent of the board of public works, to draw up a contract with the Meriden El. Lt. Co. to furnish electricity to operate the pumping station at the Broad Brook reservoir. C. A. Learned is general manager of the Meriden company.

SOUTH NORWALK, CONN.—Plans are being considered by the electric light commissioners for replacing the arc lamps in the outskirts of the city with incandescent lamps. Albert E. Winchester is superintendent of the municipal electric-light plant.

Middle Atlantic

CHERRY CREEK, N. Y.—The village of Cherry Creek has granted the Randolph El. Lt. & Pwr. Co., of Randolph, a franchise to furnish electricity here.

DEPOSIT, N. Y.—The power house of the Deposit El. Co. was recently destroyed by fire, causing a loss of about $25,000. The town at present is without electrical service.

ELMIRA, N. Y.—The Elmira Wtr., Lt. & R. R. Co. has filed notice of increase in capital stock from $2,000,000 to $5,000,000.

KINGS PARK, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, N. Y., until April 27 for electrical work in buildings A, B, C and D, at Kings Park State Hospital. Drawings and specifications may be consulted and blank forms of proposals obtained at the office of the State Hospital Commission, 1 Madison Avenue, New York; at Kings Park State Hospital, Kings Park, and at the office of Lewis F. Pilcher, state architect, Capitol, Albany. Plans and specifications may be obtained upon application to the architect. For details see proposal columns.

NEW YORK, N. Y.—The Public Service Commission has awarded the contract for the construction of Section No. 1-A of Route No. 12 (part of the Eastern Parkway subway in Brooklyn) to the Cranford Co., of Brooklyn, for $2,225,519.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, headquarters of Fire Department, 157 and 159 East Sixty-seventh Street, New York, until April 13 for furnishing and installing complete electric and gas lighting equipment in the quarters of engine company No. 18, Borough of Manhattan. Blank forms and further information may be obtained and plans and specifications seen at the above office.

NIAGARA FALLS, N. Y.—The Public Service Commission has authorized the Cliff Electrical Distributing Co., of Niagara Falls, to issue $150,000 in capital stock, the proceeds to be used to purchase additional equipment.

NORTH CREEK, N. Y.—Within the next few months the North Creek El. Co. expects to purchase an automatic waterwheel governor for high-pressure waterwheel. C. S. Wade is secretary and treasurer.

CANONSBURG, PA.—The West Penn Ltg. Co. has closed a contract with the Pittsburgh Coal Co. to furnish electricity for the Harrison mine, near Bridgeville. C. A. Hall, local superintendent of the West Penn company, has charge of installing the new equipment at the mine. About 250 hp will be required.

ERIE, PA.—Plans are being prepared by Arthur G. McKee, engineer, Rockefeller Building, Cleveland, Ohio, for an addition to power house and equipment for same for the H. F. Watson Co., of Erie.

HUNTINGDON, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 11 for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Huntingdon, Pa. Drawings and specifications may be obtained from the above office or from the custodian of site at Huntingdon. O. Wenderoth is supervising architect.

WARREN, PA.—It is reported that the Dunkirk, Allegheny Valley & Pittsburgh Railroad, which is leased by the New York Central R. R. Co., will be equipped for electrical operation between Warren and Youngsville, a distance of 9 miles, and interurban cars operated over that section of the road.

BLOOMFIELD, N. J.—The Town Council is considering the extension of the lighting system in connection with awarding a new lighting contract to the Pub. Ser. El. Co., of Newark.

BOONTON, N. J.—The Board of Public Utility Commissioners of New Jersey has granted, conditionally, the Jersey Pwr. Co. permission to issue $40,000 in capital stock, the proceeds to be used for the erection of a new transmission line from Boonton to Dover, via Fox Hill and Millbrook, and to Wharton and Rockaway, a distance of about 15 miles. The company proposes to lease the power plant of the Jersey Corporation in Boonton, to discontinue the power stations now operated by the Eastern Pennsylvania Pwr. Co. at Dover and Bernardsville, and to distribute energy from its transmission line mainly over the system of the latter company. Among the conditions imposed upon the company are the following: It is not to furnish local service either in Boonton or Hanover Township except as specifically permitted later by the board, such territory being supplied; the immediate authorization by the Eastern Pennsylvania company of the power stations to be discontinued, and the authorization of the circuit to be displaced between Millbrook and Dover.

CAMDEN, N. J.—Plans are being considered for the installation of a new boiler house, power plant, refrigeration system and ice-manufacturing factory at the new creamery to be erected at the creamery plant of the Garden State Dairies, at Eighth and Market Streets.

HIGH BRIDGE, N. J.—The Hunterdon El. Lt. & Pwr. Co., of High Bridge, is reported to be contemplating extending its transmission line to Hampton and Glen Gardner to furnish electrical service in those towns.

SPRING LAKE, N. J.—All bids submitted March 30 for lighting the streets and public places in Spring Lake were rejected. E. V. Patterson is borough clerk.

ROCK HALL, MD.—The Council is considering submitting the proposal to issue $10,000 in bonds for the installation of an electric-light plant to the voters.

MOUNDSVILLE, W. VA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 14 for the construction, including mechanical equipment and lighting fixtures and approaches, of the United States post office at Moundsville. Drawings and specifications may be obtained from the above office or from the custodian of site at Moundsville. O. Wenderoth is supervising architect.

BRIDGEWATER, VA.—The North River El. Co., of Bridgewater, expects to make considerable improvement to its plant during the coming summer. As yet nothing definite has been decided upon. G. Richard Berlin is president and manager.

FREDERICKSBURG, VA.—Within the next two months the Rappahannock El. Lt. & Pwr. Co., of Fredericksburg, expects to erect an addition to its Hazel Hill power plant for which equipment has been purchased; also within the next three months to purchase two switchboard panels, exciter, mechanical stoker and condenser, and also to purchase poles, lightning arresters and 5000 lb. of wire within the next two months. S. C. Foster is superintendent and electrical engineer.

FREDERICKSBURG, VA.—Bids will be received by the buildings and ground committee until April 15, at the office of Charles M. Robinson, Inc., architect, Times-Dispatch Building, Richmond, for construction of dormitory, complete, including heating, plumbing and electric wiring, at the State Normal and Industrial School at Fredericksburg, Va. Plans and specifications may be seen at the office of the architects, where copies may be obtained upon deposit of $10, to be refunded upon return of plans. P. J. White is chairman of buildings and grounds committee.

HAMPTON, VA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 9 for the construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Hampton, Va. Drawings and specifications may be obtained at the above office or from the custodian of site at Hampton. O. Wenderoth is supervising architect.

MONTEREY, VA.—Within the next eight months the Monterey Garage & Lt. Co. expects to install a 60-hp boiler, 45-hp engine and 30-kw generator. C. M. Lunsford is manager.

NATIONAL SOLDIERS' HOME, VA.—Bids will be received at the office of the National Home for Disabled Volunteer Soldiers, National Soldiers' Home, Va., until May 4 for remodeling telephone system. F. E. Skinner is treasurer.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 28 for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 6623—1018 composition unions; Schedule 6624—2000 ft. plain twin conductor, 350 receiver cords, 25 head gears for wireless, 200 insulators, 2000 ft. leaded and armored, soft-steel, twin-conductor wire. Brooklyn, N. Y., Norfolk, Va., and Mare Island, Cal., Schedule 6624—11,500 ft. interior communication cable. Bids will also be received until May 5 as follows: Brooklyn, N. Y.,

Schedule 6603—two 900-kw, 200-volt generators. Mare Island, Cal., Schedule 6629—22,000 lb. condenser tubes. Puget Sound, Wash., Schedule 6629—2190 lb. 1½-in. to 5-in. seamless copper tubing. Application for proposals should designate the schedule desired by number.

North Central

GRAYLING, MICH.—Bids will be received at the office of the quartermaster general, Lansing, until April 15, for the construction of a combined electric-lighting and water-supply system at the Hanson State Military Reservation near Grayling, consisting of power house, system of water mains, 40,000-gal. concrete reservoir, well, direct-current electric transmission and lighting system. Bids on all or any part of the work will be considered. Walter G. Rogers is quartermaster-general.

IONIA, MICH.—Bids will be received by Dr. O. R. Long, superintendent, until May 12 for electric wiring of a new brick building to be erected for the Ionia State Hospital. Plans and specifications may be seen after April 17 at the office of Edwyn A. Boyd, architect, of Lansing, Mich., or at the office of superintendent at Ionia.

LAPEER, MICH.—Plans are being considered by the city of Lapeer for installing a small electric-light plant to furnish electricity for lighting the streets and public places of the city.

MANISTIQUE, MICH.—The proposal of bonding the city for $35,000 for the construction of a gravity main and dam and power plant will be submitted to the voters some time this month.

MIDLAND, MICH.—Bids will be received by the city clerk until April 24 for four deep wells, 500 ft. piping for wells to tanks, 3700 ft. of 10-in. pipe for tank to present distributing system, four small pump houses of concrete and brick, two electrically operated centrifugal pumps, two electrically operated deep-well pumps and 1 mile of transmission line.

MONROE, MICH.—Bids will be received by Thomas R. Waters, secretary of board of education, until April 28 for the electric wiring of the old high school building, which is to be remodeled throughout.

ROGERS CITY, MICH.—The Michigan Limestone & Chemical Co., it is reported, is plannnig to install a 1000-hp steam turbine and generator in its power plant.

AMELIA, OHIO.—Bids will be received by W. A. Williams, village clerk, until April 18 for furnishing material and construction of an electric generating plant for the village of Amelia, according to plans and specifications on file at the office of the village clerk.

ATHENS, OHIO.—Plans are being prepared for rehabilitating the municipal electric-light plant. For further information address B. Davidson, public service director.

BLUFFTON, OHIO.—The Board of Public Affairs expects to purchase a 250-hp to 300-hp Diesel oil engine and about 15 transformers with a rating of about 10 kw. Cyrus Schumacher is superintendent.

COLUMBUS, OHIO.—Bids will be received at the office of the board of trustees of the Ohio State University, Columbus, until April 21 for furnishing material and labor as follows: (1) Construction of addition to physics building (east wing) on the Ohio State University campus; (2) an underground tunnel, approximately 684 ft. long, in accordance with specifications and drawings prepared by Joseph N. Bradford, university architect, on file in the office of the auditor of state; (3) one horizontal turbine generator in the power plant of the Ohio State University; (4) one five-retort underfeed automatic stoker in the boiler house at the Ohio State University, in accordance with plans and specifications prepared by William C. McCracken, engineer, on file in the office of the auditor of state. Plans and specifications for above improvements may also be seen at the office of the architect, the engineer and the secretary of the board of trustees. Form of proposal may be secured at the office of the board of trustees. Carl E. Steeb is secretary.

DENNISON, OHIO.—The City Council has entered into a contract with the County El. Co., controlled by the United Service Co., for lighting the streets of the city. The company, it is understood, will install new arc lamps.

FREEPORT, OHIO.—Bids will be received by the village of Freeport (Prairie Depot), Wood County, until April 16, for furnishing electricity for lighting the streets, alleys, public ways and public buildings. For details see proposals columns. H. E. West is clerk of Freeport Corporation.

HAMILTON, OHIO.—Bids will be received by W. W. Crawford, county auditor, at the office of the county commissioners, Hamilton, until April 18 for lighting fixtures for the court house, situated in Hamilton, according to plans and specifications prepared by George Barkman and F. G. Mueller, architects, copies of which may be obtained at the office of G. Mueller, Rentschler Building, Hamilton, Ohio, upon deposit of $3.

JAMESTOWN, OHIO.—Within the next few months the Jamestown El. Lt. Co. expects to purchase a few 2-kw or 3-kw transformers. S. A. Brown is secretary and manager.

JOHNSTOWN, OHIO.—The Board of Public Affairs expects to purchase within the next four months 12 lightning arresters and six electric-light meters for house service; also within the next six months wire for a complete line service for the village. D. H. Crawford is superintendent and engineer.

TIFFIN, OHIO.—As the result of the approval by the State Public Utilities Commission of a bond issue of $2,000,000, electric-light plants in nine Ohio cities and towns will be united under the control of the Ohio Lt. & Pwr. Co., of Tiffin. The plants which the company will acquire are situated in Fremont, Fostoria, New Lexington, Logan, Crooksville, New Straitsville, Shawnee and Lancaster.

BARLOW, KY.—The Barlow Lt. & Pwr. Co., recently incorporated, will install an electric plant to furnish electricical service in Barlow. The equipment will include a 230-volt direct-current generator, switchboard, etc., 3 miles of distribution lines and 500 incandescent lamps. L. F. Wider is engineer in charge. J. W. Meshew, of Barlow, is interested in the company.

CADIZ, KY.—Steps have been taken toward the organization of a company for the purpose of installing an electric-light plant in Cadiz, work on which will begin in the near future. George L. Smith, A. P. White and Stanley White, of Cadiz, are interested.

COVINGTON, KY.—The Liberty Cherry & Fruit Co., of Covington, recently incorporated, will equip, for packing maraschino cherries and candied fruits, a plant which will be equipped with electrically operated machinery. Edgar Bettman and others are interested.

IRVINE, KY.—The City Council will soon offer for sale an electric-light franchise for the town. It is understood that parties are ready to install a plant in Irvine.

LOUISVILLE, KY.—The Louisville Gas & El. Co. has applied for a permit to erect a boiler room at 217 West Washington Street. The building will be 108 ft. by 27 ft. (steel and concrete construction) and will cost about $125,000.

MAYSVILLE, KY.—The City Council is contemplating the installation of a municipal electric-light plant to furnish electricity to maintain 125 arc lamps. The cost of the plant is estimated at $22,000.

PRINCETON, KY.—The installation of a municipal electric-light plant in Princeton is under consideration. For further information address R. W. Lisanby, Mayor.

SHEPHERDSVILLE, KY.—A company is being organized by the citizens of Shepherdsville for the purpose of installing an electric-light plant, ice factory and cold-storage plant here. The company will be incorporated under the name of the Shepherdsville El. Lt., Wtr. & Cold Storage Co. with a capital stock of $10,000. It is proposed to acquire and enlarge the existing plant. The officers are: S. W. Bates, president; S. H. Ridgeway, vice-president; Conrad Maraman, secretary, and C. F. Troutman, treasurer.

BEDFORD, IND.—The power plant of the Furst-Kerber Stone Co., 4 miles north of Bedford, was destroyed by fire recently.

CRAWFORDSVILLE, IND.—Superintendent McVey of the municipal electric-light plant has recommended to the City Council the purchase of a new generator for the municipal plant, which would make it possible to add 100 arc lamps for lighting the city.

FORT WAYNE, IND.—The Board of Public Works has awarded the contract for a 3000-kw turbo-generator set, a 100-kw motor generator exciter set and switchboard complete to the Fort Wayne El. Co., of Fort Wayne, at $33,985; for condenser and auxiliaries to the Alberger Pump & Condenser Co., of New York, N. Y., for $11,902.

LOGANSPORT, IND.—The Logansport Htg. Co. is reported to be contemplating extending its transmission lines to furnish electricity for lamps and motors to the farmers throughout Cass County and also to light the county roads.

APPLE RIVER, ILL.—The Warren Lt. & Pwr. Co. is reported to have been granted a franchise to furnish electricity for lamps and motors in Apple River.

MATTOON, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, expects to rebuild at once the distribution system in Anna.

PANA, ILL.—Local business men have decided to organize a company, to be capitalized at $50,000, to construct and operate an electric-light plant. The city has been without electrical service since last November, when the Central Illinois Pub. Ser. Co., of Mattoon, refused to accept a franchise offered by the City Council. Harvey W. Ferguson is interested in the company.

URBANA, ILL.—Bids will be received by the board of trustees of the University of Illinois, Room 648, 29 La Salle Street, Chicago, Ill., until April 27 for plumbing, heating, ventilating, electric wiring and composition flooring for the addition to the chemical laboratory at the University of Illinois. James B. Dibelka, of Chicago, is state architect.

BRILLION, WIS.—Within the next two months the F. Paustian Milling Co., of Brillion, expects to erect a substation and transmission lines; also to purchase material for distribution system (to change from direct current to alternating current), and a series street-lighting system. The company has entered into a contract with the Wisconsin Pub. Ser. Co., of Green Bay, for 500 kw. A. F. Paustian is secretary.

BURLINGTON, WIS.—The Burlington El. Lt. & Pwr. Co. expects to purchase within the next six months some electrical appliances and supplies, but as yet nothing definite has been decided. W. J. Leach is electrician.

CLIFTONVILLE, WIS.—Within the next 12 months the Water and Light Commission expects to purchase one 12-in. by 30-in. simple Corliss engine directly connected to a 60-cycle, single-phase, 2300-volt generator. George C. Stewart is superintendent.

EAU CLAIRE, WIS.—The Chippewa Valley Ry., Lt. & Pwr. Co., of Eau Claire, expects to erect 50 miles of 33,000-volt transmission line within the next six months and to purchase equipment for same, including transformers, poles, lightning arresters and insulators; also to expend about $10,000 for electrical appliances and supplies within the next six months. George B. Wheeler is secretary and general manager.

EDGAR, WIS.—The installation of an electric-light plant in Edgar is reported to be under consideration.

FLORENCE, WIS.—Preliminary estimates are being prepared by D. H. Maury, engineer, 1137 Monadnock Building, Chicago, Ill., for improvements to the municipal electric-light plant in Florence. E. E. Wilcox is president water and light commission.

GREEN BAY, WIS.—The Wisconsin Pub. Ser. Co., of Green Bay, is contemplating extending its transmission lines from Wrightstown through Greenleaf to Brillion, and thence to Reedsville and surrounding country. The company has entered into a contract for a period of ten years with the Paustian El. Co., of Brillion, whereby the latter company will distribute electricity in Brillion, Reedsville, Forest Junction and Gilbert Junction. A line may be extended east from Reedsville to serve Whitelaw, Grimms and other towns.

HAYWARD, WIS.—Within the next five months the Hayward El. Lt. & Pwr. Co. is planning to build a water-power plant and expects to enter into a contract with the Northwestern El. Equipment Co., of St. Paul, Minn., for the complete installation of the proposed plant. J. F. Purnhagen is secretary and treasurer.

LUCK, WIS.—The contract for construction of a power house is reported to have been awarded to L. Helgerson, of Luck.

MADISON, WIS.—The City Council has approved the ornamental street-lighting system proposed by Alderman Frank Alford. An engineer, it is understood, will be engaged to prepare plans.

MILWAUKEE, WIS.—The City Council has awarded the contract for the proposed street-lighting survey of the city to Robert Hunt & Co., of Chicago, Ill., at $4,850. The object of the survey is to replace the present street-lighting system in such a manner as to eliminate all waste and at the same time properly light the city.

SHEBOYGAN FALLS, WIS.—The Railroad Commission has refused to grant the city permission to establish a municipal electric-light plant. The petition was refused owing to the local plant having changed hands and because the new owners contemplate making extensive improvements in the street-lighting system.

LAKE CITY, MINN.—The Board of Water and Light Commissioners is preparing to change the municipal electric-light system (now operated by steam-driven plant) to hydroelectric motive power, energy to be secured from the transmission

line of the Minnesota-Wisconsin Pwr. Corpn., of Wabasha, to be delivered at 2300 volts, alternating current. At present 60-cycle, single-phase, 110/220/1100/2200-volt, 6.6-amp alternating-current system is used. They will retain two single-phase arc-lamp panels and will probably install one single-phase lighting panel, one three-phase power panel, one total input panel with necessary voltmeters, ammeters, automatic oil and other necessary switches, transformers, etc. As yet nothing definite has been decided upon. With the installation of the new machinery and devices, etc., the city will probably overhaul the entire distributing system. It is expected to change over the system by June 1. The city is looking for an electric fire alarm apparatus that will not involve tank and compressed air. J. Cole Doughty is president of board.

WINONA, MINN.—The installation of an ornamental system on 10 blocks in the city, to cost about $8,100, is under consideration. A contract will soon be signed with the Wisconsin Ry., Lt. & Pwr. Co. to install the lamps.

ZUMBRO FALLS, MINN.—A movement has been started by business men for the installation of an electric-lighting system. A dam will probably be built across the Zumbro River.

BROOKLYN, IA.—The Grinnell El. Lt. & Htg. Co., of Grinnell, has submitted a proposition to the Town Council offering to extend its transmission lines to Brooklyn to furnish electrical service here.

LYONS, IA.—A committee has been appointed to make investigations in regard to establishing a municipal electric-light plant in Lyons. L. C. Moesinger is member of the committee.

MASON CITY, IA.—At an election held March 26 the proposal to issue $65,000 for a municipal electric-light plant was defeated.

MISSOURI VALLEY, IA.—An engine and dynamo is reported to have been destroyed by an explosion recently at the plant of the Missouri Valley El. Lt. Co.

SHELLSBURG, IA.—The Iowa Lt. & Pwr. Co., of Cedar Rapids, represented by F. J. Cross, has applied for an electric-light franchise in Shellsburg. It is proposed to erect a transmission line from Center Point, via Palo and Covington. The proposal will be submitted to the voters on April 26.

CLARKSVILLE, MO.—The City Council has granted A. Vogel, of the Louisiana Lt., Pwr. & Trac. Co., of Louisiana, a franchise to furnish electricity for lamps and motors here; also water service. The ordinance will be submitted to the voters at the April election.

EXCELSION SPRINGS, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 13 for construction, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Excelsior Springs, Mo. Drawings and specifications may be obtained at the above office or from the custodian of site at Excelsior Springs. O. Wenderoth is supervising architect.

KANSAS CITY, MO.—Bids, it is reported, are being received by Baird & Huselton, Kansas City, Mo., for wiring and installation of electric equipment in the new Muehlbach Hotel, to be erected in Kansas City.

WEST PLAINS, MO.—The Board of Water and Light Commissioners expects to erect about 1 mile of transmission line within the next six months; also to purchase about 50 meters. Within the next 12 months it expects to purchase about 100 100-cp and about 25 350-cp (5.5 amp) series street lamps. W. P. Britain is superintendent.

BUFFALO, N. D.—The property of the Buffalo El. Lt., Ht. & Pwr. Co. has been purchased by Henry Christenson, of Buffalo,, who, it is said, will increase the output of the plant.

JAMESTOWN, N. D.—The Western El. Co., of Jamestown, expects to purchase within the next 12 months electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, switches, etc. John H. Canham is manager.

NEW SALEM, N. D.—Arrangements are being made by Charles F. Peterson for the installation of an electric-lighting system in New Salem. Electricity for operating the system will be purchased from an industrial plant, now using direct current for power purposes. The equipment will include a switchboard, 100 meters, one constant-current transformer, 135 35-ft., 25 25-ft. and two 45-ft. poles, 1200 ft. No. 6 wire and 2500 ft. No. 8 wire, incandescent lamps, fixtures, etc.

TOWER CITY, N. D.—The citizens, it is reported, have decided to install a municipal electric-light plant in Iowa City, work on which will begin at once.

HECLA, S. D.—R. D. Twaddle, owner of the local electric-light plant, expects to purchase one 50-hp boiler within the next three months.

HOLSTEIN, NEB.—A committee has been appointed to investigate the feasibility of installing an electric-lighting system in Holstein.

MEAD, NEB.—Bids will be received by the Mayor of Mead until April 17 for the construction of a municipal electric-light plant. The cost of the plant is estimated at $13,000. Bruce & Standevin, 420 Bee Building, Omaha, are engineers.

POTTER, NEB.—Bonds to the amount of $15,000, it is reported, have been voted for the installation of lighting and water plants in Potter.

MINNEAPOLIS, KAN.—It is reported that H. F. Jackman, manager of the local electric-light plant, contemplates erecting a transmission line to furnish electrical service to the farmers along the river east of Bennington.

WELLSVILLE, KAN.—Plans are being prepared for the installation of an electric-light plant and ice factory, to cost about $22,000. E. B. Murray and L. C. Hamilton, Missouri Savings Bank Building, Kansas City, Mo., are engineers.

Southern States

LEXINGTON, S. C.—Within the next three months the Lexington El. Lt. & Pwr. Co. expects to purchase one 14-kw, 6.6-amp regulator. B. H. Barre is manager.

COLUMBUS, GA.—The Columbus El. Co., it is reported, contemplates improvements and extensions to its power plant and street-railway system, to cost about $300,000. The Stone & Webster Management Association, of Boston, Mass., are general managers.

CORDELLE, GA.—The white way committee of the Chamber of Commerce, it is reported, is asking for bids for an electric plant to maintain an ornamental street-lighting system, consisting of 125 to 150 posts, to cost about $5,000. The equipment to include generator, engine, switchboard (have boiler) and 900 ft. of feed wire to extend from plant to the beginning of street-lighting system. Standards for five-lamp clusters preferred. Louis Spencer is secretary of committee.

HABERSHAM, GA.—Plans and specifications are being prepared for a 400-hp hydroelectric development on the Soque River for the Habersham Mills. A three-phase transmission line will supply electricity for lamps and motors in the mills, about 1 mile distant, in the town of Habersham, and probably to other nearby towns. J. I. Linler, of Walhalla, S. C., is engineer.

MACON, GA.—Contract, it is reported, has been awarded by the city of Macon to F. M. Marshall for the construction of electrical building, at $10,073.

WOODLAND, GA.—The installation of a municipal electric-light plant in Woodsville is reported to be under consideration.

HOMESTEAD, FLA.—Preparations, it is reported, are being made to install an electric-light plant in Homestead, to cost about $30,000. J. B. McCrary & Co., of Atlanta, Ga., will have charge of the engineering work.

DICKSON, TENN.—Arrangements are being made by the Electric Light Commissioners for improvements and extensions to the municipal electric-light system, for which bonds were recently issued. The work will include putting the street lamps on a separate circuit and extending the street-lighting system to the newly annexed territory. E. S. Payne is commissioner.

JOHNSON CITY, TENN.—Arrangements, it is reported, are being made by John W. Hunter for the installation of an electric-light plant to furnish electricity for lighting, street railway and domestic purposes in Johnson City.

MARYVILLE, TENN.—The local electric-light plant, it is reported, has been purchased by Eastern capitalists, who, it is said, propose to enlarge the plant and extend the service to Johnson City, Morristown, Greeneville and other nearby towns and cities.

MEMPHIS, TENN.—We are informed that C. P. Cooper is not interested in the movement to extend the ornamental lighting system as reported in the issue of March 28. As yet no definite steps have been taken toward extending the lighting system.

NASHVILLE, TENN.—A seven-story garage, it is reported, will be built by Dr. Walter Page, to cost about $100,000, which will include a machine shop, equipped with electrically operated machinery.

PARIS, TENN.—Plans are under consideration for rebuilding the municipal electric-light plant, changing the system from three-wire, direct current, to 60 cycles, alternating current. M. W. Younkin is manager.

SPRINGFIELD, TENN.—Within the next six months the city of Springfield expects to erect an addition to the municipal power house and to install a 300-kw generating unit with condenser; also to purchase engine and generator for the above unit, exciter, circuit feeder panels and two pumps for water-works. G. B. Shawver is superintendent.

BREWTON, ALA.—The city of Brewton expects to install within the next 60 days one 250-hp engine, one 150-kw generator, two motor-driven fire pumps and one 175-hp boiler in the municipal electric-light plant. J. S. O'Bannon is superintendent.

GADSDEN, ALA.—The erection of a municipal electric-light plant is recommended to the City Council by a joint committee of the Chamber of Commerce and City Council.

BELONZA, MISS.—The Water and Light Department expects to install a duplicate generating unit in the municipal electric-light plant within the next six months; also to purchase one 100-hp boiler, one 100-hp engine, one 100-kva, three-phase, 2200/110-volt generator directly connected to engine, switchboard for above unit; also 100 25-ft., 25 30-ft., and 10 45-ft. poles, and 10 series incandescent center-span street lamps. J. J. Sisloff is manager.

HORATIO, ARK.—The City Council is reported to have granted the De Queen Ice & Lt. Co., of De Queen, a franchise to furnish electricity here.

BREAUX BRIDGE, LA.—The installation of a municipal electric-light plant in Breaux Bridge is under consideration.

JENNINGS, LA.—A deal has been closed whereby the Southern Ht. & Lt. Co. has taken over the property of the Jennings Lt. & Pwr. Co. The Jennings Co. has been reorganized under the name of the Jennings Gas & El. Co. The officers of the company are: George Z. Zigler, president; J. P. Haber, secretary, and F. N. Litten, manager.

NEW ORLEANS, LA.—Bids will be received by the Board of Commissioners of the port of New Orleans, 200 New Court House Building, New Orleans, until April 22, for furnishing and erecting, complete, ready to operate, all of the steel framing, machinery, conveyor belts and chains, electric motor, fixtures and wiring, conveying apron, corrugated galvanized iron and canvas siding and covering necessary for the construction and operation of three banana conveyors of the Harris-Eddleston type, in accordance with plans and specifications. Conveyors to be erected on the lower end of Pauline Street Wharf. Plans and specifications are on file in the office of L. H. Guerin, consulting engineer, 1002 Perrin Building, New Orleans, where copies may be obtained upon deposit of $15, to be refunded upon return of same. Robert G. Gueard is president.

BROWNWOOD, TEX. — Arrangements have been made by the Texas Pwr. & Lt. Co. for the installation of a new street-lighting system in Brownwood, to cost about $15,000, consisting of 162 tungsten lamps of 100 cp, maintained by overhead wires. Contract for material has been awarded. W. P. Murphy is manager.

CONROE, TEX.—The Conroe Gin, Ice & Lt. Co. expects to erect an ice plant within the next 12 months. J. McDade is president.

DALLAS, TEX.—The City Commission has authorized C. D. Hill, architect, to prepare plans for the installation of an ornamental-lighting and fan system for the municipal building. The cost of the work is estimated at about $10,000.

HICO, TEX.—Within the next six months the Hico El. Lt. & Pwr. Co. expects to erect 22 miles of transmission lines; also to install another turbine and boiler and to purchase one tub transformer for incandescent lamps. The company has just completed 44 miles of transmission line. H. Gleason is secretary and manager.

HUTTO, TEX.—The installation of an electric-light plant in Hutto is under consideration. Hamstrom & Tinning are reported to be interested in the project.

LOCKHART, TEX.—The owners of the Lockhart water-works expect to purchase one car load of 30-ft. (7-in.-top) poles. C. E. Jones is manager.

SAN ANTONIO, TEX.—Plans are being prepared by the San Antonio Gas & El. Co. for doubling the output of its power plant on the Conception Road. The building will

be enlarged and a 5000-kw generator installed. E. E. Eysenbach is general manager.

VAN ALSTYNE, TEX.—Within the next three months the Yoder Ice & El. Co., of Van Alstyne, expects to purchase a small amount of wire in cable (size about No. 8) suitable for conveying 440-volt, three-phase, 25-cycle current through fiber conduits. D. P. Yoder is owner and manager.

Pacific States

BELLINGHAM, WASH.—The Puget Sound Trac., Lt. & Pwr. Co., of Bellingham, expects to purchase ground detector equipment for seven substations.

EVERETT, WASH.—The installation of a tungsten street-lighting system to replace the lamps now in use is under consideration by the city commissioners. If the change is made, extensions will be made to the present system.

SOUTH BEND, WASH.—The City Council has granted Frank McKean, of South Bend, and associates a franchise to furnish electricity for lamps and motors in South Bend.

WENATCHEE, WASH.—The Cashmere Wtr. Pwr. Co., of Cashmere, recently organized, has applied to the City Council for a franchise to furnish electricity for lamps and motors in Wenatchee. The company owns water-power rights on the Wenatchee opposite Cashmere. O. B. Hollis, of Cashmere, is secretary of the company.

GOLD HILL, ORE.—The Rogue River Pub. Ser. Co., of Gold Hill, has filed on water rights on Rogue River at Hell's Gate for the development of 4000 hp. It is understood that work will begin at once on the construction of a 200-ft. dam.

KENO, ORE.—Contracts have been awarded by the Keno Pwr. Co., recently incorporated, for the construction of a 1000-hp power plant. The equipment will include two Leffel turbines, one 250-hp and the other 600-hp; Woodward waterwheel governors; General Electric three-phase, 60-cycle, 2200-volt generators, switchboard (General Electric Thomson type), 400-kva transformers (three-phase and single-phase, 2200/100-volt), Oregon fir poles for 15 miles of high-tension transmission line, 150 hp in motors for operating pumps for irrigation purposes, and about 200 lamps for farming districts. J. W. Kerns is engineer in charge.

MILTON, ORE.—Within the next two months the city of Milton expects to build 3000 ft. 50-in. continuous-stave wood power flume to increase the hydraulic head, thereby increasing the municipal electric power plant by 260 hp, for which machinery has already been installed; also to purchase 22 ft. 6-ft. standpipe, to be made of ¼-in. boiler plate and erected on top of the 56-ft. standpipe now in use, and a 2000-lb. balance flywheel for turbine shaft. L. E. Boyle is manager.

MYRTLE POINT, ORE.—Preparations are being made by the Oregon Pwr. Co. to rebuild its distributing system in Myrtle Point and Coquille, at a cost of about $10,000.

PORTLAND, ORE.—The Portland Ry., Lt. & Pwr. Co. in acquiring the control of the Willamette Valley Southern Ry. Co. will guarantee the $700,000 in bonds to be issued by the latter company and will take charge of construction and operation of the 32 miles of line from Oregon City to Mollala and Mount Angel, Ore. About 7 miles of the railway is completed. Energy for operating the railway will be supplied by the Portland Ry., Lt. & Pwr. Co.

PORTLAND, ORE.—George H. Cecil, United States district forester, has issued a special permit to the Golden Gate Mining Co., which is developing mines in the Whitman National Forest, in the Blue Mountains, to erect a power house, conduit and auxiliary improvements for generating and transmitting electricity. The site of the project is in Grant County, and the water will be diverted from Granite Boulder Creek, a tributary of the John Day River. The power house will be erected about 6 miles from Greenhorn and 500 hp is to be developed.

SUMMERVILLE, ORE.—A. Klees & Son, owners of the local electric-light plant, have reorganized under the name of the Klees Wtr. Pwr. Co. Plans, it is reported, have been prepared and preliminary work completed for the erection of a larger central station and distributing system and also for an auxiliary steam plant. The company will also furnish electricity in La Grande.

BAKERSFIELD, CAL.—The trustees have decided to install ornamental lamps in the downtown district. Ornamental pressed-steel posts (14 ft. high) carrying five-lamp clusters will be used. Bids will be asked for furnishing and installing standards on Nineteenth Street, between G and M Streets, and on Chester Avenue, between Twenty-fourth Street and the Santa Fé tracks.

COLTON, CAL.—Preparations are being made by the Pacific Fruit Express Co. to install a 250-kw turbo-generator set at its pre-cooling station in Colton. The turbine will be operated by exhaust steam from the ice machines.

GREENVILLE, CAL.—Several mining companies have made application to the Great Western Mining Co., of San Francisco, for the erection of a transmission line from Butte Valley through the Seneca district into Indian Valley.

LOS ANGELES, CAL.—The City Council has decided to call an election in May to submit the proposal to issue $6,500,000 bonds to complete the aqueduct power project and for distribution system for same.

LOS ANGELES, CAL.—The City Council has adopted a resolution instructing the Board of Public Works to advertise for bids for furnishing electricity for street-lighting for a period of 18 months. The resolution provides for the installation of 500 additional street lamps in different parts of the city.

MILL VALLEY, CAL.—The State Railroad Commission has granted the Marin County El. Ry. Co. authority to construct a street railway in Mill Valley and to sell $67,000 in stock for same. The first branch of the new railway will run up to the Cascades and the base of the trails to Tamalpais, Muir Woods, Big Lagoon and the Bolinas district. W. Wesley Hicks is general manager.

OCEANSIDE, CAL.—The Oceanside El. & Gas Co. has been asked to extend its transmission lines from Oceanside to South Oceanside and Carlsbad to furnish electrical service in those districts.

POMONA, CAL.—Plans are being prepared by Paul F. Higgs, architect, for the civics committee of the Chamber of Commerce for an ornamental street-lighting system for the city. The plans provide for an electrically lighted arch to be erected on Garey Avenue and for a series of 300 ornamental lamps for the more important business and residential streets.

SOUTH PASADENA, CAL.—Committees have been appointed by the Chamber of Commerce and the Board of Trade to promote the movement for the installation of an ornamental street-lighting system. It is proposed to bring the whole city under a uniform system.

MALAD CITY, IDAHO.—The City Council has granted a franchise to G. C. McLaughlin to install and operate an electric-lighting system in Malad City.

GREEN RIVER, UTAH.—The town of Green River is contemplating the installation of a municipal electric-light plant at the Green River mill race about 6 miles north of the town. The cost of the plant and transmission line is estimated at $10,000.

PROVO, UTAH.—The city of Provo has entered into a contract with the Utah Pwr. & Lt. Co., of Salt Lake City, for lighting the streets of the city. The contract calls for fifty 6.6-amp luminous-arc lamps.

SALT LAKE CITY, UTAH.—A committee, consisting of Charles Tyng and W. J. Halloran, was appointed from the board of governors of the Commercial Club to investigate the question of installing an oil-burning electric-generating plant in the Commercial Club Building.

HELENA, MONT.—At a special election held March 28 the proposal to grant the Standard El. Co., of Seattle, Wash., a franchise was defeated.

DENVER, COL.—Extensive improvements and extensions are contemplated by the Denver Gas & El. Co. during the current year, including the installation of a new switchboard to handle all the electric circuits of the company in Denver and surrounding territory, at a cost of about $200,000, and extensions to its electric light and power and gas-distributing systems.

DENVER, COL.—Work will begin on construction of the union depot and terminals in Denver as soon as the season's heavy tourist traffic is over. The total cost of the work is estimated at $4,000,000, of which $300,000 will be used for remodeling the present union station, $150,000 for new train sheds, $160,000 for subways for passengers, baggage and express, $110,000 for electric safety equipment and $3,280,000 for extension of terminal yards, etc.

TRINIDAD, COL.—The City Council has instructed the city attorney to prepare a contract with the Trinidad El. Transmission, Ry. & Gas Co. for the installation of 115 ornamental street lamps. The posts are to be installed by the company. The standards will be 29 ft. high and equipped with four-lamp clusters and will also carry the trolley supports. The 1000-cp arc lamps in the residence portion of the city will be changed for tungsten lamps. Work has begun on the installation of the system. Franklin P. Wood is manager of the Trinidad Co.

Canada

BRIGDEN, ONT.—Tenders will be received by the Town Council for an automatic engine, generator, storage battery, switchboards, etc., of sufficient rating to furnish electricity to maintain 25 60-watt street lamps; also for lighting about 100 residences, averaging about 150 watts. R. B. Brown is secretary of town council.

HAVELOCK, ONT.—The Havelock El. Lt. & Pwr. Co. expects to erect a boiler house and to purchase a 300-hp boiler and engine, complete, to cost about $7,000, for use as an auxiliary during low-water periods. Aleck Rose is secretary.

GROSSE ISLE, QUE.—Tenders will be received until April 20 for an electric generator, steam engine, switchboard, etc., for quarantine station, at Grosse Isle. Plans and specifications may be obtained from the Department of Public Works, Ottawa, Ont. R. C. Desrochers is secretary.

ST. LAMBERT, QUE.—The town of Lambert is contemplating installing a new street-lighting system. The plans provide for the erection of 43 standards carrying five-lamp clusters and the installation of 7050 ft. of single conduit. The Montreal Lt., Ht. & Pwr. Co., of Montreal, furnishes electrical service in St. Lambert.

CARLYLE, SASK.—We are informed that contracts have been placed for equipment and work for extensions and improvements to the municipal electric-lighting system. Work will soon begin on the proposed extension. Reported in the issue of March 28 to be contemplating extensions and improvements to the plant. John Salt Engineering Co., of Winnipeg, Man., has charge of the engineering work.

New Incorporations

DOVER, DEL.—The Electrical Pwr. Co. of the Western States of America has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $3,000,000. The company proposes to operate generating plants, distribute electricity, etc. The incorporators are W. J. Maloney and O. J. Reichard, of Wilmington.

SHANNON, IDAHO.—The Salmon River Pwr. & Lt. Co. has been incorporated with a capital stock of $400,000. The company, it is understood, will build a power plant near Shannon. The incorporators are C. L. Mackenzie, H. H. Bloomer, Grant Smith, Edward Riggs and Ralph Irwin.

MOUNT VERNON, ILL.—The City Railway Co. has been incorporated with a capital stock of $40,000 to construct and operate an electric railway in Mount Vernon. The incorporators are L. G. Pavey, C. C. Baldwin and E. Green.

DEXTER, MAINE.—The Ripley Lt. & Pwr. Co. has been incorporated for the purpose of erecting transmission lines between the lines of the Central Maine Pwr. Co., in Dexter and Ripley Mills, to furnish electricity for lamps and motors to farms along the road and at Ripley Mills. The officers are M. E. Tibbetts, president; Fred Tibbetts, vice-president and treasurer, and Percy A. Hasty, clerk.

KIMBALL, NEB.—The Kimball El. & Pwr. Co. has been incorporated with a capital stock of $25,000 by William Dubois, Theodore C. Theile and J. D. Clark.

LUZERNE, N. Y.—The Riddell El. Lt. Co. has been incorporated with a capital stock of $10,000 by Edward E. Riddell, Myron B. Riddell and Edward J. Riddell.

SOCIETY HILL, S. C.—The Society Hill Pr. Co. has been incorporated with a capital stock of $4,000 by Bright Williamson, of Darlington, S. C., and J. E. Blackman, of Society Hill.

BURTON, WASH.—The Vashon El. Co. has filed articles of incorporation with a capital stock of $75,000. The incorporators are H. H. Edwards, S. J. Linden, E. W. Edwards and Ivy L. Linden.

TORONTO, ONT., CAN.—The Stanworth Pwr. Co. has been incorporated with a capital stock of $250,000 by W. J. Simpson, Stewart W. Hall, Robert E. W. Duke, Alfred Wales and H. G. Hammond. The company proposes to do a general power development and power distribution business.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 31, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,091,488. ATTACHMENT FOR INTERNAL COMBUSTION ENGINES; W. W. Dodge, Chicago, Ill. App. filed April 3, 1911. Electric heater attached to intake.

1,091,500. SELF-WINDING CLOCK; N. Friedman, New York, N. Y. App. filed April 20, 1912. Operated by ordinary high-voltage lighting current.

1,091,505. SWITCHING DEVICE; D. D. Gordon, Chicago, Ill. App. filed Sept. 10, 1912. Pull switch with oscillating switch member yieldingly held in either position.

1,091,528. CIRCUIT DETECTOR; W. J. Murdock, Chelsea, Mass. App. filed Feb. 23, 1909. Telephonic testing set for testing for continuity, short-circuits and grounds.

1,091,548. ELECTROMAGNETIC BELL; E. W. Vogel, Chicago, Ill. App. filed Nov. 10, 1909. For railway crossings; operated by solenoid.

1,091,559. ELECTRODE; J. W. Brown, Lakewood, Ohio. App. filed July 28, 1911. Built-up furnace electrode which may be added to as consumed.

1,091,562. PLUG SOCKET; L. J. Castonguay, Harrisburg, Pa. App. filed Feb. 1, 1911. Key-socket structure with multi-lock shell.

1,091,563. VAPOR ELECTRIC APPARATUS; J. T. H. Dempster, Schenectady, N. Y. App. filed April 4, 1904. Has contact points spaced apart and disposed between the electrodes for starting.

1,091,564. VAPOR ELECTRIC APPARATUS; J. T. H. Dempster, Schenectady, N. Y. App. filed April 4, 1904. Series of fluid electrodes between the main electrodes.

1,091,582. ELECTRICAL WATER HEATER; R. R. Lockhart, Winnipeg, Manitoba. Canada. App. filed May 28, 1913. For use in connection with ordinary range boiler.

1,091,586. CIGAR LIGHTER; J. F. O'Connell and C. E. Whiteman, La Grande, Ore. App. filed July 22, 1910. Lighter wick automatically ignited when swung to operative position.

1,091,589. INDUCTION COIL; A. Flecher, Las Animas, Col. App. filed March 16, 1912. Plurality of both primary and secondary windings with an intermediate magnetic core.

1,091,613. DYNAMO-ELECTRIC MACHINE; E. F. W. Alexanderson, Schenectady, N. Y. App. filed July 27, 1910. Constant flux obtained by a winding in shunt to the load circuit mounted on a portion of the field magnet, which is of restricted cross-section.

1,091,614. DYNAMO-ELECTRIC MACHINE; E. F. W. Alexanderson, Schenectady, N. Y. App. filed July 7, 1911. Has connections forming for the commutator brushes, a local circuit for producing a secondary magnetic field and an external circuit.

1,091,616. GRAPHITE CONDUCTOR; W. C. Arsem, Schenectady, N. Y. App. filed March 13, 1911. Homogeneous filament consisting of a graphite base and a graphite coating.

1,091,630. ELECTROMAGNETIC DEVICE; E. R. Carichoff, Schenectady, N. Y. App. filed June 25, 1909. "Notching relay" for increasing potential to motor step by step.

1,091,632. SYSTEM OF VEHICLE PROPULSION; A. Churchward, New York, N. Y. App. filed March 10, 1910. Generator operated by internal-combustion engine, with lock for the accelerator pedal, which is controlled according to current being generated.

1,091,637. ELECTRIC VAPORIZER; C. L. Davis, Detroit, Mich. App. filed May 9, 1913. For explosion engines using kerosene, etc.

1,091,641. ARC LAMP; J. T. H. Dempster, Schenectady, N. Y. App. filed Nov. 16, 1903. Novel construction of "non-consuming electrode" and electrode feed mechanism.

1,091,648. METHOD OF CONNECTIONS FOR STARTING METALLIC-VAPOR LAMPS; F. Girard, Hanau, Germany. App. filed Oct. 9, 1911. Resistance automatically put in series before starting and removed when predetermined value of operating current is reached.

1,091,650. ELECTROMAGNET; E. J. Guay; Lynn, Mass. App. filed April 11, 1907. Has tubular armature fitting inside solenoid and provided with upturned arms inclosing the outside of the solenoid.

1,091,653. TELLTALE FOR COMPASSES OR THE LIKE; J. L. Hall, Schenectady, N. Y. App. filed Jan. 7, 1911. For indicating movements of the magnetic compass in various parts of the ship.

1,091,659. OIL SWITCH; E. M. Hewlett, Schenectady, N. Y. App. filed Nov. 7, 1904. Has a wooden oil pot.

1,091,661. METHOD OF AND MEANS FOR DETERMINING THE RATINGS OF INCANDESCENT LAMPS; W. G. Housekeeper and H. S. Dunning, Philadelphia, Pa., and New Dorp, N. Y. App. filed May 16, 1910. Measuring instrument consisting of an indicator and a chart, one of which parts is connected with the movable member of the photometer.

1,091,669. VAPOR-ELECTRIC APPARATUS; O. O. Kruh, Schenectady, N. Y. App. filed Aug. 7, 1905. A wire shield protects the solid electrode.

1,091,678. INSULATING COMPOSITION; F. M. Locke, Victor, N. Y. App. filed May 19, 1909. Aluminum silicate having a boron compound incorporated therein.

1,091,679. INSULATOR; F. M. Locke, Victor, N. Y. App. filed March 9, 1909. Silica and boron fused together in a homogeneous body.

1,091,680. VAPOR-ELECTRIC DEVICE; F. W. Lyle, Lynn, Mass. App. filed Oct. 11, 1911. A thermal device renders the tilting means inoperative while the temperature exceeds a predetermined limit.

1,091,694. AUTOMATIC TRAIN-STOPPING SYSTEM; J. L. Neble, Omaha, Neb. App. filed April 14, 1913. Brushes on train engage conductors at inner sides of rails.

1,091,713. INDUCTION MOTOR; C. L. Spinney, Lynn, Mass. App. filed Sept. 30, 1912. Squirrel-cage armature whose conductors have inclined ends integrally united with the short-circuiting rings.

1,091,714. ELECTRIC COOKING DEVICE; W. Stanley, Great Barrington, Mass. App. filed Dec. 21, 1912. Flat disk-shaped heating unit for broiling.

1,091,716. VOLTAGE REGULATOR; C. W. Stone, Schenectady, N. Y. App. filed Dec. 7, 1909. Auxiliary device linked with a Tirrill regulator.

1,091,722. SYNCHRONISM INDICATOR; V. A. Wolcott, Butte, Mont. App. filed Sept. 9, 1911. Electrostatically actuated indicator connected between insulating supports.

1,091,725. INSULATING COMPOSITION; L. E. Barringer, Schenectady, N. Y. App. filed Jan. 18, 1913. Gum copal, castor oil, rubber resin and colophony.

1,091,733. ELECTRIC HEATING AND VENTILATING DEVICE; F. J. Cook, Cleveland, Ohio. App. filed June 27, 1913. Has tubular heating units located directly in the heat-conveying conduit.

1,091,734. SUPPORT FOR ELECTRIC TROLLEY MECHANISM; F. C. Coseo, Columbus, Ohio. App. filed Feb. 13, 1904. For mine locomotives; can be positioned below the top surface of the locomotive.

1,091,738. ELECTRIC BRAKE; R. R. Dunlop, Columbus, Ohio. App. filed Jan. 17, 1905. For preventing too rapid descent of an elevator or conveyor.

1,091,748. DYNAMO-ELECTRICAL MACHINE; E. C. Ketchum and D. H. Andrews, Boston and Newton, Mass. App. filed April 25, 1912. Equal balance of the armature avoids end thrust.

1,091,755. GAS BURNER; W. W. Ogden, Maquoketa, Ia. App. filed Jan. 23, 1912. Thermal-controlled electromagnet cuts off gas when flame is extinguished.

1,091,756. TRAIN-LOCATING AND TIME-RECORDING APPARATUS; B. F. Osborn and E. F. Zirbel, Ripley, Ia. App. filed Feb. 8, 1911. Annunciates location of trains throughout a division.

1,091,764. THERMOSTAT; H. E. Reeve, New York, N. Y. App. filed Sept. 11, 1913. Thermal insulator interposed between the thermostatic arm and its support.

1,091,765. AUTOMATIC SELECTOR SWITCH; J. N. Reynolds, Greenwich, Conn. App. filed July 8, 1911. Panel type, for automatic or semi-automatic exchange systems.

1,091,767. ELECTRICAL CONNECTION FOR SADIRONS AND THE LIKE; E. A. Rutenber, Logansport, Ind. App. filed Dec. 10, 1912. Insulated and mechanically protected plug connection.

1,091,768. METHOD OF AND APPARATUS FOR SELECTIVE WIRELESS TELEGRAPHY; F. G. Sargent, Westford, Mass. App. filed Nov. 14, 1912. Synchronously revolving indicators at sending and receiving stations indicate by their position at the instant of transmitting a signal the character intended to be signaled.

1,091,774. ELECTRIC HEATING DEVICE; M. H. Shoenberg, San Francisco, Cal. App. filed Nov. 6, 1912. Particularly for heating milk bottles.

1,091,782. VAPORIZER; O. P. Underwood, Des Moines, Ia. App. filed June 23, 1913. With electric heater, heat supplied being proportional to fuel being consumed.

1,091,804. PRINTING METER; J. E. and F. L. Burch, St. Louis, Mo. App. filed May 10, 1913. Dot made upon record sheet at every twenty-fifth revolution of watt-meter shaft.

1,091,808. ELECTRIC CRUCIBLE FURNACE; D. F. Calhane, Worcester, Mass. App. filed Nov. 3, 1911. Current is forced to flow in a restricted path along the walls of the crucible.

1,091,820. COMBINED TYPEWRITING AND ADDING MACHINE; A. H. Ellis, Kingston, N. Y. App. filed Aug. 8, 1905. Permits inspection and erasure of wrong numerals so that they are not added.

1,091,832. SELECTIVE SIGNALING SYSTEM; E. R. Gill, Yonkers, N. Y. App. filed Sept. 18, 1909. Telephonic train dispatching.

1,091,875. ELECTRICAL CONTACT; H. J. Wiegand, Milwaukee, Wis. App. filed Aug. 3, 1911. Sheet-metal contact of cupped form adapted to be embedded in plastic composition with only its head exposed.

1,091,898. ELECTRIC BELL; C. J. Schwarze, Adrian, Mich. App. filed Sept. 11, 1912. Single-stroke bell with pendulum hammer.

1,091,902. BELL-RINGING APPARATUS; W. F. Wacker, Sioux City, Ia. App. filed Aug. 25, 1913. Has electromagnetically operated means for coupling the motor to the oscillating bell shaft after it has reached proper speed.

1,091,932. STEERING WHEEL; J. S. Hill, Bethesda, Md. App. filed Feb. 12, 1914. Has plurality of grips containing lamps or like heating elements.

1,091,940. MOTOR CONTROLLER; W. B. Lucas, Chicago, Ill. App. filed Jan. 7, 1910. Has means for automatically reducing the starting resistance in the motor circuit.

1,091,942. HANGER; C. Mather, Passaic, N. J. App. filed April 8, 1913. For supporting cables placed in conduits.

1,091,961. ELECTRIC-LIGHT FIXTURE; R. C. Ratto, Waterbury, Conn. App. filed Aug. 21, 1913. Central body portion and radiating arm construction in which the wiring is facilitated.

1,091,965. TELEPHONE MOUTHPIECE PROTECTOR; C. Russell, Columbus, Ohio. App. filed July 21, 1913. Truncated conical protector which may be made to collapse and be carried in the pocket.

1,091,995. TRANSFORMER; N. A. Wolcott and W. C. Woodland, Warren, Ohio. App. filed May 12, 1910. Equalizes the magnetitc density in the various parts of the yokes.

1,092,009. GROUNDING DEVICE; G. A. Bishton, Cedar Rapids, Ia. App. filed Feb. 10, 1912. Uses a driving element by which a relatively thin, flexible conducting strip can be driven into the ground.

1,092,037. PLUG SWITCH; T. E. Gambrell, London, England. App. filed Nov. 13, 1913. For use with resistance boxes, Wheatstone bridges and the like.

1,092,063. SIGNALING APPARATUS; E. D. Lopez, New Orleans, La. App. filed Oct. 9, 1912. Electrically operated semaphore and bell; automobile rear signal.

1,092,065. METHOD OF ASCERTAINING THE NATURE OF SUBTERRANEAN STRATA; H. Löwy, Göttingen, Germany. App. filed April 1, 1913. Determines the variation of capacity and frequency and damping coefficient as compared with a prior calibration.

1,092,083. ELECTRIC LAMP; C. P. Steinmetz, Schenectady, N. Y. App. filed Dec. 19, 1903. Starts the arc by relatively moving the two bodies of vaporizable material.

1,092,117. ELECTROMAGNETICALLY OPERATED SOUNDER; C. J. Schwarze, Adrian, Mich. App. filed Oct. 13, 1910. Loud-sounding alarm.

13,710 (reissue). TELEPHONE EXCHANGE SYSTEM; H. G. Webster, Chicago, Ill. App. filed June 3, 1903. (Original patent 668,452, dated Dec. 10, 1901.) Improved line-signaling mechanism.